An Introduction to
Quantitative Techniques in Competition Analysis

Lexecon

economics of competition policy & regulation

Lexecon Ltd is a firm of economists specialising in the application of economic analysis to competition law disputes, regulatory matters and other legal issues with an economic aspect.

Lexecon's principal areas of expertise include:

- merger control analysis;

- investigation of alleged dominance and complex monopolies;

- analysis of potentially anti-competitive agreements;

- regulatory and competition advice;

- state aid disputes;

- litigation and the assessment of damages; and

- trade related cases.

Contents

1 The use of quantitative techniques

1.1 Introduction

Empirical analysis lies at the heart of modern competition policy. The outcomes of merger cases, dominance claims and the assessment of potentially anti-competitive agreements all depend on the accurate analysis and interpretation of empirical evidence. This Lexecon Ltd publication provides an overview of the wide range of quantitative techniques that are available for use in competition inquiries.

1.2 The role of quantitative techniques

It is sometimes suggested that quantitative techniques require high quality data which are usually unavailable. A related observation which is often heard is that the better the data quality, the more obscure and complex is the analysis. In reality, both concerns are overstated. The case for seeking to carry out empirical analysis remains compelling for the following reasons.

First, as this publication will illustrate, many quantitative techniques can be successfully executed using fairly rudimentary data. Many of the available techniques (including, for example, switching analysis, bidding studies and shock analysis) can produce highly effective results with basic information. The intuitive and accessible nature of these techniques means that they can be understood by a wide audience.

Second, it is undeniable that some of the more sophisticated techniques raise complicated technical issues and require considerable expertise on the part of the practitioner. However, precisely because of their sophistication, these techniques can yield exact answers to the questions that are pivotal to competition cases. Competition authorities are increasingly well versed in these areas. The European Commission, for example, is now familiar with both merger simulation and econometric analysis. It is clear that the role of the more complex approaches outlined in this publication will continue to expand.

1.3 Which technique?

The following quantitative techniques are covered in this publication.

- **Price correlation analysis**

  This examines the extent to which the prices of two products move together over time. If the price of one good constrains the price of the other, the two price series follow a similar pattern.

- **Stationarity analysis**

  This is a more sophisticated variant of price correlation analysis. Stationarity analysis does not suffer from some of the complications associated with price correlation analysis.

- **Price elasticity analysis**

  This uses econometrics to assess the responsiveness of the demand for a product or group of products to a change in price. The more elastic the demand, the less likely is it that a price rise would be profitable.

- **Critical loss analysis**

  This makes the SSNIP market definition test operational by estimating how much the hypothetical monopolist's sales would have to fall in order to make the hypothesised price increase unprofitable.

- **Switching analysis**

  This uses econometric analysis, internal company documentary evidence or survey results to estimate the extent to which two products are particularly 'close' competitors.

- **Merger simulation**

  This combines estimates of demand elasticities with an assumption about the nature of competition to simulate the competitive impact of a proposed merger.

- **Price/concentration analysis**

  This explores the degree to which higher levels of concentration coincide with higher prices and margins in order to give an insight into the likely competitive impact of an increase in market concentration.

- **Shock analysis**

  This involves the analysis of discrete events affecting competition in the market to obtain an insight into the competitive interaction between products or regions.

- **Bidding studies**

  In some markets, competition takes the form of bidding for (often large) contracts. The analysis of bid outcomes can identify the extent to which merging firms compete with each other.

- **Damages assessment**

  It is possible to quantify the impact of anti-competitive behaviour using statistical techniques; this chapter uses the assessment of damages associated with price fixing to show what can be achieved.

The choice of technique will depend on both the specific circumstances of the case and the availability of data. Also, it is possible that more than one technique could be usefully applied to any particular case.

1.4 About this publication

We have deliberately made this publication as non-technical as possible. It is designed to be accessible to non economists and, as a result, some of the more high level specialist material has been simplified. Our aim is to demonstrate what can be done, rather than to set out the technicalities of how to do it. In each chapter, we summarise the intuition behind the technique, explain how it has been used, and mention a number of further issues which need to be considered when applying the technique.

We have used a number of case studies to illustrate the use of quantitative techniques in actual cases. The case studies should be viewed as stylised summaries of the issues raised in each case rather than detailed accounts of the investigations. None of the examples used in the text reveal commercially sensitive information. Some examples relate to competition cases which are not in the public domain and so have been disguised accordingly. Finally, since market circumstances change, it cannot be assumed that the conclusions reached in each of the cases cited remain valid today.

2 Price correlation analysis

2.1 Introduction

The intuition behind price correlation analysis is that there is a limit to how far prices of products within the same relevant market can diverge before either demand-side or supply-side substitution forces them back into line. As a result we would expect the prices of products in the same market to move together over time. Similarly, if two regions are in the same geographic market, prices of a given product in both regions should follow a similar pattern over time.

2.2 The basis of the approach

The first point to stress is that two products can compete in the same relevant market despite being priced at different absolute levels, as demand-side substitution depends on the willingness of consumers at the margin to switch from one product to another as the relative price changes. Price correlation analysis examines whether price levels move together, so it can be thought of as assessing the extent to which relative prices change over time.

The next step is to quantify the extent to which price levels move together over time. This is measured by the correlation coefficient. The correlation coefficient is mathematically defined so that it always varies between +1 (moving perfectly together) and -1 (moving perfectly inversely to one another). A correlation of zero means that there is no statistical association between the two series. Chart 2.1 below illustrates the approach graphically.

Chart 2.1: Illustrating correlation coefficients
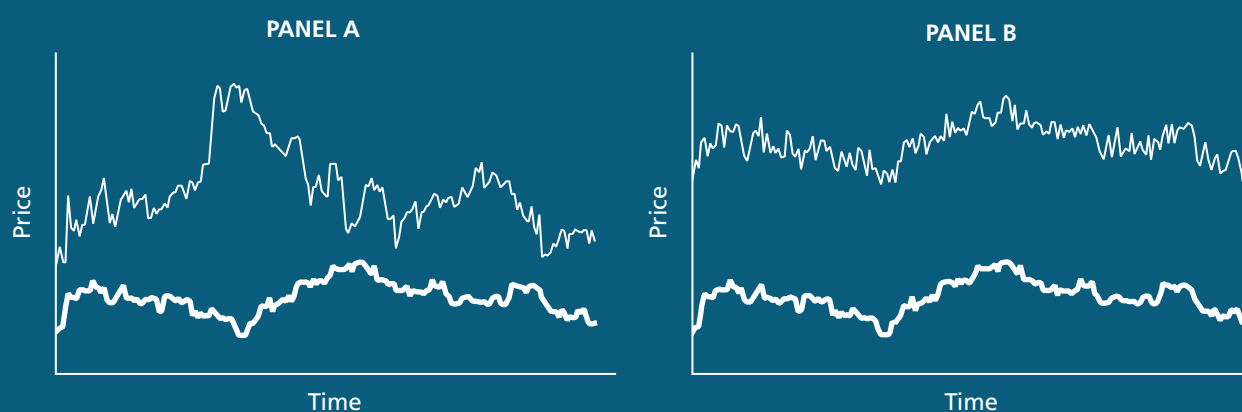
Panel A shows two price series which appear to move independently of each other (the correlation coefficient between these two price series is low – less than 0.3). In contrast, Panel B illustrates two price series which move together very closely (with a very high correlation coefficient – greater than 0.9). Panel B might, therefore, represent the prices of two products in the same market. In contrast, Panel A is more likely to represent two products that are not close substitutes.

Example: BP/E.ON (Aral) [1]

Price correlation analysis can help in the assessment of the relevant geographic market. For example, in the 2001 merger of BP and Aral in Germany an important issue was whether the wholesale markets for petrol and diesel were wider than Germany, and in particular whether Germany was in the same market as the Antwerp, Rotterdam and Amsterdam (ARA) region. To provide evidence on the appropriate geographic market definition for these products, Lexecon undertook a price correlation analysis based on quoted wholesale prices in different locations. We looked at the correlation between the wholesale prices of petrol and of diesel in eight regions of Germany and in the ARA region.

The results showed the following. First, the wholesale prices of petrol in the regions of Germany were all very highly correlated with one another. Second, the regional prices of wholesale petrol in Germany were all very highly correlated with the wholesale price of petrol in the ARA region. The same results were obtained for wholesale diesel. Moreover, the same results were obtained when we controlled for the common effect the price of crude oil had on the wholesale prices of both petrol and diesel in all the regions of Germany and in the ARA region – the effect of common costs on correlation analysis is discussed below. These results strongly suggested that the markets for wholesale petrol and diesel were wider than Germany and included the ARA region. The Bundeskartellamt concluded that the wholesale markets for these products were wider than national.

Example: Nestlé/Perrier 2

The Nestlé/Perrier case is a very early example of the use of correlation analysis and is still instructive as it demonstrates the potential power of the technique. In this case, the European Commission initially considered that there might be two relevant product markets: in high mineralised still water and low mineralised still water. In contrast, Nestlé considered the relevant market to include all soft drinks, including water and colas. A price correlation analysis showed that all of the water brands were highly correlated with one another regardless of whether they were sparkling or still. Further, the correlations between the water brands and the soft drink brands were much weaker. This evidence suggested that the market should include both still and sparkling waters but should exclude soft drinks. The correlation analysis provided firm objective evidence (which was accepted by the Commission) for a relevant product market consisting of all bottled water.

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[1] *Bundeskartellamt, Case B8 – 130/01*

[2] *Case No IV/M.190, OJ L356*

2.3 Complications

The interpretation of price correlation analysis raises at least two substantial complications. First, how high does a correlation coefficient have to be for two products or regions to be in the same relevant market? Although there is no absolute answer to this question, the issue is frequently resolved through benchmarking. Second, how can we limit the possibility that a high correlation is driven by some common influence other than competitive interaction (known as spurious correlation)? Both issues are addressed in turn below.

Benchmarking

The observation that two prices are correlated might imply some degree of substitution between the two products, but the key question is whether this substitution is sufficiently strong for both products to be considered as part of the same relevant market. The analysis is complicated by the fact that the degree of correspondence of two price series can vary with the frequency of observations, the type of price reported and other factors.

Benchmarking offers a way around this problem. The correlation coefficient between two products which are accepted as being in the same relevant market can be established as a benchmark against which other correlation results can be gauged. The Nestlé/Perrier case set out above provides an example of this technique. It is fairly uncontentious to argue that one brand of still water in a given geographic market is in the same relevant product market as other brands of still water. The average correlation between still brands gives a benchmark of the correlation coefficient consistent with two products being in the same relevant market. If the average correlation coefficient between each still brand and each sparkling brand is equal to or above this benchmark, this suggests that still brands and sparkling brands form part of the same relevant market.

Table 2.2 presents some results of the benchmarking analysis from the full sample of products.

Table 2.2: Benchmarking

Still-still	0.89
Still-sparkling	0.90
Sparkling-sparkling	0.94

The average correlation coefficient among the prices of the five major still water brands in the sample was 0.89 and the average correlation among the prices of the five sparkling brands was 0.94. However, the average correlation between the price of still and sparkling brands was 0.90. Still brands were therefore approximately as correlated with sparkling brands as they were with one another. This suggested that the two types of water products were part of the same relevant market.

Avoiding spurious correlation

A spurious correlation is one that falsely suggests that two products compete with one another when in reality the statistical relationship can be explained by other factors. Spurious correlation can arise in a number of ways.

• Common costs

A correlation analysis can be distorted by the presence of common costs. Two unrelated products or regions might display a high degree of correlation merely because they share the same major input. For example, the cost of crude oil has a substantial impact on the production costs of petrol in every country, so the retail prices of petrol in different countries tend to be highly correlated, even though geographic markets for petrol at the retail level are generally considered to be, at most, national. This issue can be addressed by carrying out the correlation analysis after stripping out the common costs from the price series for the products being tested (there are several methods for doing this).

• Inflation

Inflation can also distort the price correlation analysis. For example, in a high inflation country the prices of most products are likely to be correlated to some degree merely because most prices will be increasing over time, rather than as a result of competitive interaction between products. Since inflation exaggerates price correlations between all pairs of products, it can be difficult to distinguish clear benchmarks. Correlation analysis can still be undertaken after adjusting prices for the impact of inflation, or it can be based on price differences from one period to the next (rather than on price levels).

• Exchange rates

As stated above, price correlation analysis is sometimes used to assess whether two or more countries form part of the same relevant geographic market. In such cases, price data from each country is required. Prior to undertaking the correlation analysis, the price data must be denominated in the same currency. The results of such analysis are sensitive to the choice of currency and can be ambiguous.

2.4 Conclusion

It is often the case that adjustments need to be made to the raw data to avoid misleading results when undertaking a price correlation analysis but if appropriate adjustments are made it can be a powerful and convincing technique. Price correlation analysis can be further refined, as the following chapter on stationarity analysis demonstrates.

3   Stationarity analysis

3.1 Introduction

The use of stationarity analysis as a technique for defining relevant product and geographic markets is a relatively recent development in competition analysis. The intuition underlying the approach is the same as that which underpins price correlation analysis: if two products are in the same relevant market then the price of each will constrain the other, so the prices of the two products should move together over time. The advantage of stationarity analysis is that it is a more robust and reliable technique, as it does not suffer from some of the complications associated with price correlation analysis discussed in the previous chapter.

3.2 The basis of the approach

Stationarity analysis, like price correlation analysis, measures the extent to which price levels move together over time. It does this by examining how the relative price of the two products, or the relative price of the same product in two different areas, behaves over time. Specifically, stationarity analysis tests whether the relative price tends to return to a stable value over time, and if it does, how quickly the relative price reverts to its long-run value. If two products are in the same market, then unless there have been major structural changes in the market, we would expect competitive interaction between the products to ensure that the relative price of these two products rapidly reverts to a constant long-run value.

If a data series tends to return to a stable long-run value over time, then the series is said to be stationary. If it does not, but instead tends to drift about widely, then the series said to be is non-stationary.

Chart 3.1 Illustrating stationary and non-stationary data series
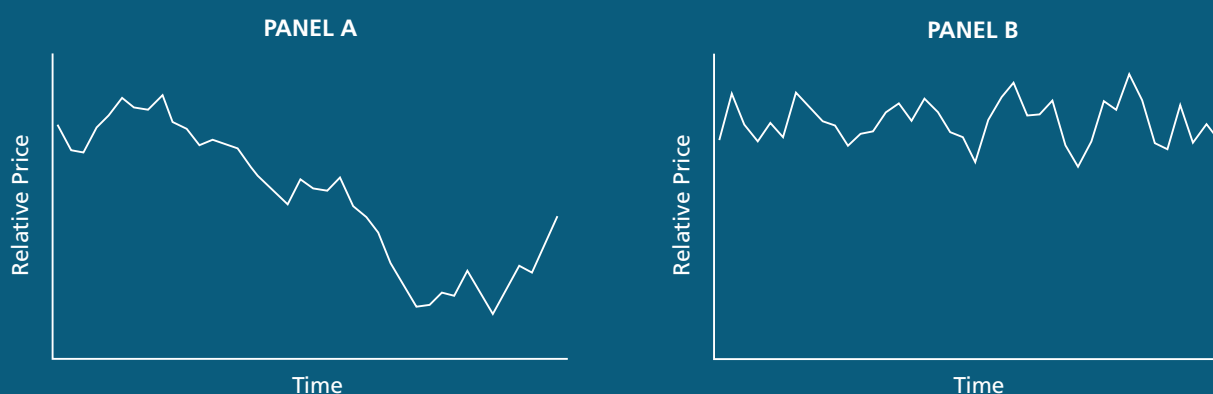
In Chart 3.1 above, Panel A shows a data series that is non-stationary – it shows no tendency to return to a stable value over the period. Panel B, on the other hand, shows a stationary data series – the series rapidly reverts to a constant long-run value over the period. If two products are in the same market then we would expect the relative price of these two products to behave in a similar fashion to the data series in Panel B.

Stationarity analysis can be extended to see if more than two products are in the same relevant market. This is done by first selecting one of the products as the base product and calculating the relative price of each product relative to this base. The test then involves examining whether all the relative prices of the products are simultaneously and jointly stationary. If they are, then this is consistent with all the products being in the same relevant market. If the standard approach is used, then the test result is the same regardless of the choice of base product. This exercise can also be carried out to assess whether two or more areas are in the same relevant geographic market.

As stated above, the main advantage of stationarity analysis is that it does not suffer from some of the complications associated with price correlation analysis.

Common influences

The results of stationarity analysis are not affected by common influences, as stationarity analysis examines the behaviour of the relative price over time. As discussed in Chapter 2, common influences are factors that have similar effects upon the price levels of both products, such as costs that are common to both products or high inflation. Since the relative price is just the ratio of the prices of the two products, it is not affected by similar changes in the price levels of the two products, as these simply cancel each other out.

Exchange rates

As noted in the previous chapter, the results of correlation analysis can be sensitive to the choice of the base currency when assessing whether two or more countries form part of the same geographic market. However, the results of stationarity analysis do not depend upon the choice of currency. This means that stationarity analysis is a particularly appropriate technique for assessing whether countries which use different currencies are in the same geographic market.

Delayed responses

The price of a product may not immediately respond to a change in the price of a substitute product, as, for example, it might take consumers time to identify the price change and then switch to the cheaper product. Since correlation analysis looks at the relationship between the current prices of products, a delay in the response of prices may generate a low correlation coefficient even if products are in the same market. However, because stationarity analysis tests both whether the relative price of the products reverts to a constant value over time and the speed of any reversion, it explicitly allows for the possibility that there may be a delay in the response of prices.

Example: Nutreco Holding NV/Hydro Seafood GSP (UK CC case) [3]

The proposed merger of Nutreco and Hydro Seafood illustrates how stationarity analysis can be used to answer questions of product and geographic market definition. Both parties owned salmon fish farms and produced gutted salmon in Scotland. After the proposed merger they would have controlled a large share of the supply of gutted Scottish salmon. The two key market definition questions raised by the proposed merger were as follows. First, did Scottish salmon and Norwegian salmon compete in the same product market? Second, if there was a single market for all gutted salmon, was this market national or EEA wide?

Chart 3.2 is relevant in addressing the first question. It shows the weekly delivered price of Scottish salmon in the UK relative to the estimated weekly delivered price of Norwegian salmon in the UK over a three year period from 1997 to 2000.

Chart 3.2: Price of Scottish Salmon relative to the price of Norwegian salmon in the UK
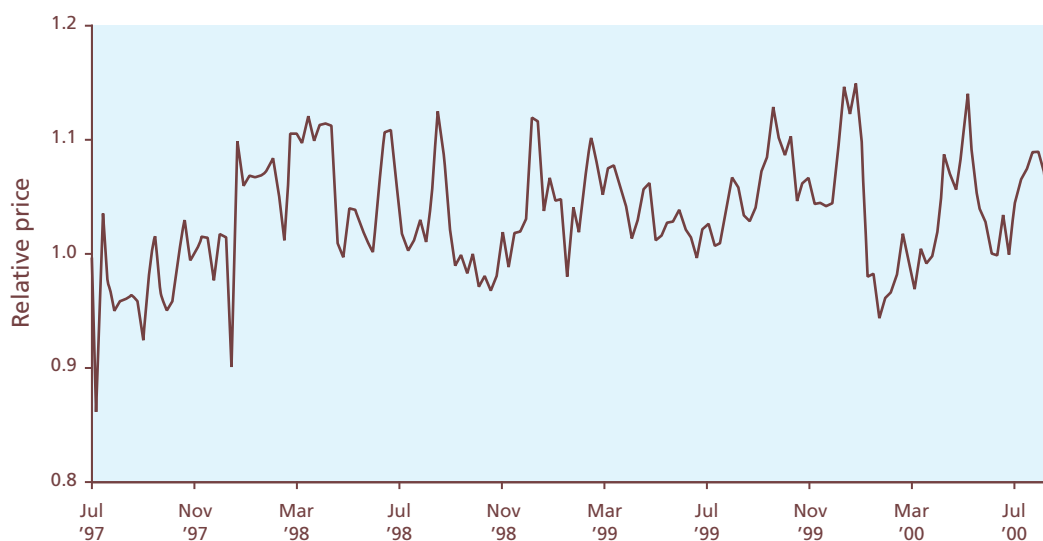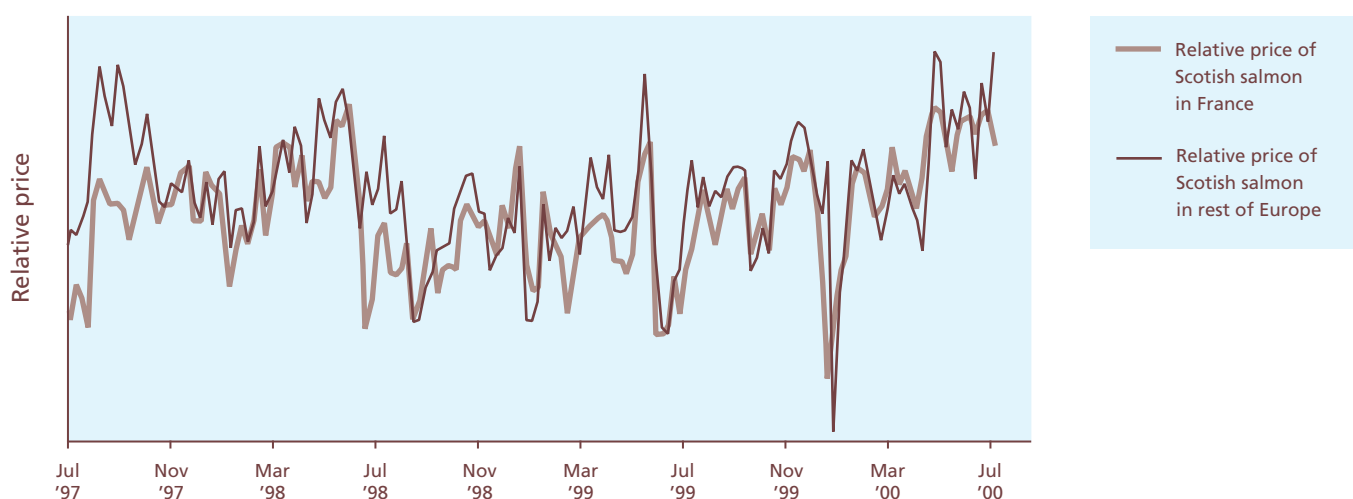

The above chart shows that the price of Scottish salmon relative to the price of Norwegian salmon in the UK appears to vary randomly around a constant long-run value, which suggests that the relative price is stationary. The econometric test for stationarity confirms that the relative price of Scottish salmon is stationary, which is what we would expect to observe if Scottish and Norwegian gutted salmon compete in the same product market in the UK.

[3] *UK Competition Commission (2000): Nutreco Holding NV and Hydro Seafood GSP Ltd:
   A report on the proposed merger (CM 5004)*

Chart 3.3 helps in the assessment of the second question. It shows the weekly prices of Scottish salmon in France and in the rest of Europe relative to the price of Scottish salmon in the UK, over the three year period 1997 to 2000.

Chart 3.3: Prices of Scottish salmon in France and the rest of Europe relative to the UK

The chart shows that the relative prices of Scottish salmon both in France and in the rest of Europe appear to vary randomly around a constant long-run value over the period, which suggests that both relative prices are stationary. This impression was confirmed by econometric tests, which found that the relative prices of Scottish salmon in the UK and in the rest of Europe were stationary. This is consistent with a geographic market for salmon encompassing the UK and France, as well as other European countries.

The UK Competition Commission accepted the results of the stationarity analysis, and concluded that there was a single market for gutted farmed salmon extending across the whole EEA.

Example: Schümann Sasol/Price's Daelite

This case involved the merger of Schümann Sasol, a wax producer, and Price's Daelite, a producer of household candles. Wax is a major input into the production of household candles, so the merger was a vertical merger. Since Schümann Sasol was the major producer of wax in South Africa, an important issue was whether imports of wax acted as a competitive constraint on domestically produced wax. To examine this question, Lexecon used stationarity analysis. Specifically, we examined whether there was a stable relationship between the price of domestically produced wax and the price of imported wax over time: i.e. whether their relative price was stationary over time. The results of the stationarity analysis showed that this was the case, which was consistent with imported wax acting as a competitive constraint on the price of domestically produced wax.

3.3 Complications

The results of stationarity analysis are valid only if sufficient data are available to ensure that the statistical test for stationarity can be robustly estimated, if there is sufficient variation in the price data, and if the prices being analysed are themselves non-stationary. This last condition is necessary because if two prices are stationary (meaning they have a tendency to revert to a normal level), then the ratio of the two will necessarily be stationary. Other complications associated with stationarity analysis include the following.

Changes in market structure

Changes in the structure of the market during the period covered by the data may cause changes in the relative prices of the products in that market, and in particular make the relative prices non-stationary. For example, if the quality of one product improves compared to other products in the market, then its relative price may permanently increase. This increase will make its relative price appear non-stationary, even though the product is still competing with others. If the change in the market structure can be identified, and data on the change are available, then it may be possible to take account of this change. This problem also affects correlation analysis.

3.4 Conclusion

The introduction of stationarity tests represents a significant improvement on price correlation analysis. Although the latter can be a robust technique, the complications associated with its application can render the results ambiguous. Stationarity analysis is a more sophisticated approach which directly addresses many of the problems that can be associated with price correlation analysis. When data are available, stationarity tests can materially improve the accuracy of market definition analysis.

4 Price elasticity analysis

4.1 Introduction

The SSNIP test approach to defining markets examines whether a hypothetical monopolist of a given collection of products would be able to raise prices and increase profits as a result. This question can be examined directly by estimating the own-price elasticity of demand of the collection of products in question. This own-price elasticity of demand measures the extent to which revenue is lost when price is increased. Accurate measurement requires the use of econometric analysis.

4.2 The basis of the approach

Econometrics uses historical data to isolate the impact of different factors on a given variable. Specifically, a dependent variable, such as the demand for a product, is assumed to be a function of several 'independent variables'. With data of sufficient quality, the impact of each of these independent variables on the dependent variable can be isolated. Statistical significance tests can then be carried out to ascertain how robust these relationships are. The larger the own-price elasticity of a good, the greater the change in volume will be in response to a given change in price; in effect, the less likely a hypothetical monopolist is to find a price increase profitable. The concept is explained in detail below.

Own-price elasticity

The own-price elasticity of a product (or group of products) is defined as the percentage change in sales for each percentage change in the price. If the own-price elasticity of demand is 'high' then the candidate market definition is likely to be too narrow. It would not be worth becoming a monopolist over this collection of goods, as any attempt to raise price would lead to large numbers of consumers substituting to other goods not in the candidate market and consequently to a reduction in profit. In contrast, if the own-price elasticity is 'low' then a hypothetical monopolist of the goods in the candidate market would find it profitable to increase price significantly. This is because the decline in sales volume is not sufficient to outweigh the increased profit resulting from the higher price. In this case, the collection of goods is a relevant market.

The importance of costs

This raises an immediate question: how elastic does the demand for a collection of goods have to be before it can be stated categorically that the proposed market definition is too narrow? The answer to this question depends on the gross margin (the difference between price and average variable costs) and the size of the hypothesised price increase. This information combined with the estimated own-price elasticity can be used to calculate whether a monopolist could profitably raise the prices of the products in question by a small amount.

Cross-price elasticity

In discussions of market definition, the importance of cross-price elasticities is often misunderstood. The cross-price elasticity between two products measures the extent to which the volume of sales of one responds to changes in the price of the other. A cross-price elasticity does not address the market definition question directly but it can provide useful information about the nature of competition between products and the reliability of the estimated equation. First, it provides evidence about which other products are close substitutes for the product under scrutiny. Second, it is natural to expect a high cross-price elasticity if it is claimed that two products are in the same relevant market. However, there are exceptions, such as when a product faces a number of weak substitutes. Under these circumstances, a price rise might still be unprofitable but no one product experiences a major increase in demand (sometimes referred to as 'death by a thousand cuts').

Residual demand analysis

The ability of a firm to exercise market power depends on the own-price elasticity of the market demand and the reactions of competitor firms. Responses of competitor firms to a price rise generally cannot be observed directly, which means that estimating the degree of 'market power' possessed by the firm under study is far from easy. Residual demand analysis is a sophisticated quantitative technique that attempts to estimate the demand for an individual firm's products after allowing for the reactions of rival firms – this is the firm's residual demand curve. This technique can provide an estimate of the firm's market power and can be used to assess whether or not the proposed merger would increase its market power. However, this technique is technically demanding and has high data requirements.

The following cases are examples of the type of econometric analysis that can be undertaken.

Example: Software

A key issue in a recent case involving software products was whether there was a distinct market for software being used for certain applications, or whether this software was part of a wider market. To investigate this, Lexecon used data on prices and sales volumes to estimate the own-price elasticity for software used in the applications of interest. The results of the estimation implied that the own-price elasticity for software used for these applications was about 1.1 – i.e. a 1% increase in the prices of these products led to a 1.1% fall in sales volume. This suggested that demand for this group of products was elastic, but not very elastic. To assess whether this meant that there was a separate product market, we collected data on the gross margins for the software in question and calculated whether, given an own-price elasticity of 1.1, a monopolist could profitably increase the prices of these products by 5 to 10%. The gross margins for these products were in the range of 35% to 45%, implying that a monopolist would find it profitable to increase prices by significantly more than 5% and 10%. Thus, the estimated own-price elasticities strongly suggested that the software in question formed a separate product market and was not part of a wider product market.

Example: Consumer toiletries

Another example of a case where Lexecon has estimated demand elasticities was a merger involving two producers of consumer toiletries. As the case is confidential, we use the hypothetical example of shampoo as a proxy to illustrate the analysis. An important issue in the case was whether certain speciality shampoos, such as anti-dandruff shampoos, formed distinct product markets or whether there was a market for all types of shampoo. To investigate this, Lexecon used data on the retail sales and prices of different types of shampoo to estimate a multilevel demand system. This involved estimating the demand for all shampoo as well as the demand for the different types of shampoo. The results of the analysis showed that the own-price elasticity for anti-dandruff shampoo was about 1.6 (i.e. a one percent increase in the price of anti-dandruff shampoo would lead to 1.6 percent fall in sales). The own-price elasticities for the other types of shampoo were greater than 1.6. Since the margins on anti-dandruff shampoo were estimated to be between 70 and 80 percent, this meant that a monopoly supplier of anti-dandruff shampoo could not profitably increase the price by 5 to 10%, so the product market was wider than anti-dandruff shampoo.

Example: Guinness/GrandMet [4]

Lexecon undertook a range of empirical studies in the Guinness/GrandMet merger. These included econometric analysis which supported the conclusion that separate spirit categories (such as whisky, gin, vodka etc.) were relevant markets. It also gave an insight into competition between international brands and local brands. The analysis also indicated that alternative market definitions such as 'white spirits' (which would include gin and vodka) and 'dark spirits' (such as brandy and whisky) did not constitute relevant markets.

[4] Case No IV/M.938, OJ L288

4.3 Complications

Econometrics is a highly technical subject and no attempt is made here to summarise all of the issues which have to be addressed in modelling demand. Some general points are as follows.

Data issues

Econometric analysis requires long and consistent series of the relevant data and these are often not available. Some variability in relative prices is also required to produce meaningful results. It works best under circumstances of reasonable market stability, where product characteristics and consumer tastes do not change markedly.

Common mistakes

Estimating elasticities raises a number of complex issues and it can be easy to misinterpret results. For example, it is quite common to find that products are complements rather than substitutes. This means that the value of each is enhanced by the consumption of the other. This interaction has to be taken into account when interpreting results Similarly, there is the problem of measuring the wrong elasticity. Between any two products there are always two cross elasticities. There is no reason why these two elasticities should necessarily have the same magnitude. For example, a fall in the price of wheat may devastate the market for rye, but a fall in the price of rye may hardly be noticeable in the much bigger market for wheat.

A final caveat

The fact that econometrics is a technical subject which is not accessible to the non-statistician makes it open to abuse. By virtue of its technical nature, a number of different econometric approaches to the same problem may be feasible. Cynics suggest that this means that an unscrupulous econometrician can produce whatever outcome is desired. Such 'data mining' can undermine the validity of the whole exercise. This means that it is important that the bodies which evaluate econometric studies (often the competition authorities) both employ their own technical specialists and approach the issue with an open mind.

4.4 Conclusion

Price elasticity analysis can produce highly rewarding results. The best means to this end, however, requires the use of econometric analysis. This can be time-consuming and highly technical. It also requires the competition authority itself to acquire the requisite technical skills, or at least to be able to assess the relative merits of conflicting submissions. At its best econometrics can provide definitive evidence, and many US anti-trust cases have revolved around the interpretation of econometric analysis. In Europe, the use of econometrics is growing and competition authorities now frequently undertake their own analysis.

5 Critical loss analysis

5.1 Introduction

Critical loss analysis makes the SSNIP test operational by estimating how much the hypothetical monopolist's sales would have to fall in order to make the hypothesised price increase unprofitable. This benchmark can then be compared to estimates of the actual response of customers to price increases; if the empirical evidence suggests that sales would fall by more than the critical loss benchmark, then the hypothesised price rise is unprofitable and the relevant market is wider than the candidate market. Given that critical loss analysis is a recasting of the SSNIP test, it is primarily used to assist in the definition of markets, although it can also be used in the assessment of the unilateral effects of a merger.

5.2 The basis of the approach

The price increase contemplated in the SSNIP test has two opposing effects on the hypothetical monopolist's profits. It has a negative effect on profits because sales will fall as some consumers substitute to rival products in response to the increase in price. However, there is an offsetting positive effect on profits as the hypothetical monopolist now earns higher margins on all of its remaining sales. If the negative effect on profits is greater than the positive effect, then the price increase will be unprofitable for the hypothetical monopolist, and the relevant market is wider.

Critical loss analysis involves estimating the maximum amount (in percentage terms) by which sales of the products in question can fall following the hypothesised price increase and still ensure that the hypothetical monopolist's profits do not decline – this is the point at which the two effects on profits exactly cancel each other out.

The only information that is required to calculate the critical loss is an estimate of the hypothetical monopolist's gross margin on the last units sold in the market (the gross margin is the difference between price and average variable costs). Given an estimate of the gross margin, the critical loss for any hypothesised price increase can be calculated using a standard formula. Table 5.1 shows the critical loss for various combinations of the gross margin and the hypothesised price increase.

Table 5.1: Critical loss estimates for different gross margins and price increases

Gross margin (percentage)	Price increase (percentage)		
	5%	7.5%	10%
10%	33%	43%	50%
20%	20%	27%	33%
30%	14%	20%	25%
40%	11%	16%	20%
50%	9%	13%	17%

Table 5.1 shows that for any given price increase, the critical loss is smaller the higher the gross margin. This is because when the gross margin is higher, there is a larger negative effect on profits arising from the fall in sales (caused by the increase in price). The table also shows that for any gross margin the critical loss is higher the greater the hypothesised price increase. This is because the larger the hypothesised price increase, the greater the positive effect on profits from the higher margins made on the remaining sales.

Once the critical loss has been calculated, it is then necessary to estimate the likely loss of sales associated with a price rise of the hypothesised amount. If this evidence (which can be compiled using a range of techniques, including demand estimation, shock analysis and switching surveys) suggests that the actual loss would be greater than the critical loss, then the products in question do not form a relevant market (the price increase would not be profitable). Thus, the estimated critical loss provides a benchmark against which evidence on actual consumer behaviour can be compared; it does not on its own directly answer the question posed by the SSNIP test.

Example: Merger in the metals sector

In a recent confidential case, Lexecon assessed the antitrust risks associated with a potential merger between two producers in the (relatively concentrated) market for a particular metal. Lexecon used critical loss analysis to examine the parties' post-merger incentives to reduce output and thereby raise prices. The analysis involved calculating by how much prices would have to rise to make a small reduction in output profitable for the merged firm. These necessary price increases were then compared with evidence on how prices in this industry would actually be expected to respond to changes in demand, to see whether this strategy would be profitable for the merged firm.

The extent to which prices would have to rise to make various 'holdback' strategies profitable was calculated using detailed information on the merging parties' costs of production, and taking into account the specific cost characteristics of this metals industry. Estimates of by how much prices would actually be expected to increase if demand were reduced were evaluated using information on demand in the industry. A comparison of the necessary price increases and the expected actual price increases showed that the merged firm would not have an incentive to restrict output and thereby increase prices, as actual demand was sufficiently elastic that the loss from reduced sales would outweigh the gains from increased prices.

Example: Tenet Healthcare Corporation [5]

This case involved the merger of the only two general hospitals in Poplar Bluff, Missouri. A key issue in the case was whether the relevant geographic market was wider than Poplar Bluff, and hence whether the two hospitals competed with hospitals in neighbouring towns. The FTC sought to block the merger on the grounds that the geographic market was not wider than Poplar Bluff, suggesting that the merger would have removed the main competitive constraint on each hospital.

The parties submitted a critical loss analysis to support their argument that the market was wider than Poplar Bluff. They estimated that the merged hospital would have earned a gross margin of about 65% on its last group of patients. Therefore a 5% price increase would have been unprofitable if more than 7% of the merged hospital's patients switched in response to the price increase: i.e. the critical loss was 7%. Given that about 55% of the merged hospital's patients would have come from areas where a significant proportion of patients already used hospitals outside Poplar Bluff, the defendants argued that the merged hospital would have lost more than 7% of their patients if they increased prices, and so the market was wider than Poplar Bluff.

Although the district court found that the geographic market was slightly wider than Poplar Bluff and ruled in favour of the FTC, the circuit court overturned this decision. In reversing the district court decision, the circuit court noted that many patients in Poplar Bluff already used hospitals in neighbouring towns and that just a small proportion of patients switching would constrain the merged hospital.

[5] *FTC v. Tenet Healthcare Corp. 186F. 3d 1045, 1050 (8th Cir. 1999)*

5.3 Complications

There are a number of potential complications associated with critical loss analysis.

Potential misinterpretation of gross margin

One common mistake made in critical loss analysis is to conclude that because large gross margins mean that the critical loss is small, it follows that the relevant market is wide. This is not necessarily so. For example, large margins can be observed in industries with differentiated products in which the products of different firms are not close substitutes. Large margins might also be the result of anticompetitive conduct (they might, for example, arise if the firms in the market are already engaged in coordinated behaviour).

How large a price increase?

A range of hypothesised price increases should be used in critical loss analysis, as it is possible that while a 5% price increase would not be profitable for a hypothetical monopolist, a slightly larger price increase would be profitable. This can occur if some existing consumers are more responsive to price changes than others. It is possible, for example, that some consumers might use the product in question for a different purpose and will therefore consider different substitutes. In this situation a small price increase might be unprofitable as a result of the more price sensitive customers switching to substitutes. However, a large price increase might be profitable if the remaining customers have fewer substitutes available and are therefore less inclined to switch.

5.4 Conclusion

Critical loss analysis can be considered as a recasting of the standard SSNIP test, rather than an alternative methodology for use in defining markets. Critical loss analysis helps the assessment of market definition and the potential unilateral effects of a merger by providing a benchmark against which to compare evidence on how consumers actually behave.

6 Switching analysis

6.1 Introduction

Many mergers take place in differentiated product markets in which one product is not a perfect substitute for another. Unilateral effects are more likely to be of concern in merger cases which bring together particularly close substitutes, especially when product repositioning is relatively costly: the 'closer' the two products, the higher the likely price rise post-merger. In such cases, market shares may not be particularly informative about the extent of competition between the merging parties. Switching analysis is one means by which the degree of substitutability between two products can be assessed.

6.2 The basis of the approach

Switching analysis can take a variety of forms, but the underlying intuition is the same: it involves the evaluation of the closeness of competition between the products (or brands) of the merging parties by analysing consumer behaviour (ideally observed behaviour, but sometimes responses to hypothetical choices can be very informative).

'Diversion ratio' analysis can be considered as a formal specification of this approach. The diversion ratio from product A to product B is the fraction of sales lost by product A to product B when the price of product A increases by a certain amount. If the effect of a rise in the price of Product A is that a third of lost sales go to Product B, then the diversion ratio from Product A to Product B is 0.33. This ratio captures some sense of the extent to which two products are substitutes, with a high diversion ratio strongly suggesting that the two products are close substitutes.

It is possible to estimate the diversion ratio to a high degree of accuracy using own-price and cross-price elasticities estimated using the techniques discussed above in Chapter 4. The diversion ratio can also be used to estimate the likely magnitude of post-merger price rises, although such results need to be interpreted in conjunction with an analysis of the likelihood of entry and the scope for product repositioning after the merger. Further, synergies associated with the merger (particularly those that lead to a decline in marginal costs) should also be considered.

However, less sophisticated switching studies can also produce very informative results with considerably lower data requirements. For example, if the data on customers gained and lost by a firm show that most of these customers were gained from or lost to a particular rival firm, then this would strongly suggest that this rival firm's product was the closest substitute. Further, a variant of switching analysis can be used to provide evidence on geographic market definition. The analysis involves examining where customers are located. Of particular interest is the proportion of customers located in areas where there is the option of using rival suppliers, as these customers are more likely to switch following a price rise.

[6] Case No COMP/M.2706

Example: Carnival Corporation/P&O Princess [6]

In this 2002 merger case, Lexecon was retained by Royal Caribbean Cruise Lines (RCCL). Lexecon was involved in the design of a survey to assess the extent to which the P&O and Cunard (owned by Carnival) brands were close substitutes. These two brands were considered 'British' premium brands (in contrast to more 'international' brands offered by a range of operators). The results were highly suggestive that the P&O and Cunard brands were close competitors; 46% of Cunard cruisers would have chosen P&O when asked about their next best alternative and 26% of P&O cruisers would have chosen Cunard. This was the highest response in both cases. The survey also showed that customers preferring one international brand were disproportionately likely to prefer another international brand. Despite apparently recognising during the administrative procedure that this survey showed that P&O and Cunard were especially close competitors, the Commission ultimately cleared the merger (RCCL's rival bid for P&O Princess had already been cleared by the UK's Competition Commission).

Example: Volvo/Renault [7]

In this 2000 merger case, the Commission considered evidence on customer switching that showed that the two merging brands were not close substitutes, despite relatively high shares in the affected markets. For example, in France (where the merging parties would have had a post-merger share of about 50% of truck sales) the analysis showed that relatively few truck customers switched between Volvo and Renault. Instead, the customers of both firms tended to switch to other truck manufacturers, such as Scania and DAF. This evidence suggested that Volvo and Renault trucks were not close substitutes. This analysis was supported by evidence that showed that there was little reaction from rival manufacturers when Volvo implemented a price rise in the French market (see Chapter 9 for a full discussion of shock analysis). The merger was cleared with conditions in Phase I.

Example: Postal services

This example is based on a (confidential) real case in the postal delivery sector. 'NationalPost' (a hypothetical name used to denote the large national operator by whom Lexecon was retained in the real case) wanted to buy 'BusinessParcel' (used to denote the business-to-business parcel service operator which was the merger target). Whereas the combined market share seemed relatively high, a switching study undertaken by Lexecon indicated that the parties offered very different services and were not competing head-to-head. The analysis used a database kept by BusinessParcel on the contracts it lost and won which showed that it had lost few contracts to NationalPost, and won few from them, in comparison with other competitors.

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[7] Case No COMP/M.1980

[8] UK Competition Commission (1997); London Clubs International plc and Capital Corporation plc:
 A report on the merger situation (CM 3721)

Example: Capital Corporation/London Clubs (UK MMC case) [8]

In this case Capital Corporation, owner of two high quality casinos located in Mayfair in London, was subject to a hostile takeover bid by its rival London Clubs, which owned seven casinos in London. On behalf of Capital Corporation, Lexecon commissioned a survey of Capital Corporation's clients. They were asked 'If this casino were not available today, which other London casino or casinos, if any, would you visit? Please list up to three casinos in order of preference'. The survey suggested that if either Capital Corporation casino were unavailable they would choose to visit casinos owned by London Clubs. Survey evidence also revealed that many of the respondents were London residents. Both results supported the hypothesis that the relevant market was narrow (and not international as was being claimed by London Clubs). The MMC concluded that the relevant market consisted of ten 'upper segment' casinos (eight of which were located in Mayfair). The MMC recommended that the merger be blocked and the Secretary of State concurred.

6.3 Complications

In common with most other quantitative techniques, switching analysis can be undertaken with varying degrees of sophistication. In its most robust form, econometric techniques can be used to estimate the diversion ratio between the merging parties' products and the effect the merger would be expected to have on prices. The caveats set out in Chapter 4 also apply here. Other issues include the following.

Devising surveys

Care should be taken when constructing consumer surveys. It is important for the survey questions to be framed objectively; many studies have shown that the results of a survey can be distorted by 'framing bias', where the way the question is phrased can determine the outcome achieved. Such bias is often apparent to competition authorities: a badly phrased question can undermine the credibility of a whole survey. Also, although surveys usually involve the assessment of hypothetical behaviour, questions asking respondents to quantify their preference (i.e. 'how much would you be prepared to pay for Product A compared to Product B?') are often less reliable than those which asks respondents to rank their preferences (i.e. 'do you prefer Product A at price X or Product B at price Y?') or to state what they would do if a certain product or service were not available.

Misinterpretation of diversion ratios

Diversion ratios cannot be estimated from the market shares of the two firms. The idea that if Product A has a market share of 20% and Product B has a market share of 25% then the diversion ratio from A to B is necessarily about 0.31 (i.e. 25% of 80%) and that from B to A is necessarily about 0.27 (i.e. 20% of 75%) is wrong. It assumes that all products within the market are 'equally close' to each other. The aim of a switching study is to study the possible differences among products in the degree to which they are substitutable. Assuming that products are 'equally close' defeats the purpose of the analysis.

6.4 Conclusions

Switching analysis has the considerable attraction that it incorporates some concept of how 'close' two products are, a concept that is not captured by market share figures. This type of analysis can be particularly useful at the early stages of a merger as a method for analysing whether a transaction is likely to run into anti-trust difficulties: it is simple to estimate, produces intuitive results and has relatively modest data requirements.

7 Merger simulation

7.1 Introduction

Merger simulation is another merger assessment technique that can bypass the need for a protracted debate over market definition. It is a technically demanding approach which combines demand elasticities with an assumption about the nature of competition to estimate directly the unilateral effects of a proposed merger on the prices and outputs of market participants.

7.2 The basis of the approach

To estimate what prices and outputs would be after a proposed merger involves a two stage process. First, estimates of the own-price and cross-price elasticities for all the major brands in the industry are required. Second, an assumption has to be made about the nature of the competition between the brands.

In the first stage, estimates of the demand elasticities of the major brands in an industry can be obtained in two ways. They can be econometrically estimated, which raises the issues discussed in Chapter 4 on price elasticity analysis. Alternatively, a very strong assumption can be made about the structure of consumer demand, and then elasticities for all the brands can be calculated using data on the prices and outputs of the main brands and estimates of the own-price and a cross-price elasticity for just one brand. In the second stage, the typical assumption made about the nature of competition is that products are differentiated and producers set prices ('Bertrand competition').

Given the estimated demand elasticities and the assumption about the nature of competition, post-merger prices and outputs are obtained by calculating the prices that the merging parties would set to maximise their joint profits. This process involves taking account of two factors. First, in setting their prices following the merger, the merging parties will take into account the fact that if they increase the price of some of their brands, then some of the brands to which customers switch will now be owned by the merging parties, so overall the merged firm would lose fewer customers. Second, if the merging parties change their prices, then this creates an incentive for rival suppliers to follow this price change, which in turn creates scope for a larger initial price change by the merging parties. The post-merger equilibrium position is reached when no firm in the industry has an incentive to unilaterally change its prices.

Example: Centrica's acquisition of the Rough gas storage facility [9]

In 2003, the Competition Commission investigated the impact of Centrica's acquisition of Rough – a depleted gas field in the North Sea used for storing gas in the summer for use in the following winter – on competition in the UK's gas markets. Lexecon prepared a merger simulation analysis to assess whether the acquisition gave Centrica an incentive to withhold sources of flexible gas supply in order to increase the price of Rough capacity.

The first step in the simulation analysis was to estimate Centrica's residual demand for gas. This enabled us to estimate how much winter gas Centrica would have to withhold in order to increase the difference between summer and winter gas prices sufficiently to raise the value of Rough by a penny per storage unit. Data from the 2002/3 storage year was used to estimate the residual supply curve for wholesale gas; this, in turn, was used to derive Centrica's residual demand curve.

Lexecon then simulated the effects of the merger. This involved quantifying the likely costs and benefits to Centrica of holding back wholesale gas in the winter to raise the price of Rough storage, taking into account the fact that Centrica also operated in the downstream retail gas market. The likely costs and benefits were quantified using the estimate of Centrica's residual demand curve, along with estimates of various other factors, such as Centrica's ability to pass on increased gas costs to final customers in the downstream gas market.

The results of the analysis showed that the cost to Centrica of withholding gas would exceed the benefit it would receive from higher Rough prices. Therefore, Centrica would have no incentive to withhold gas in the wholesale market following the merger. The Competition Commission broadly accepted the conclusions of the Lexecon report and dropped this issue, recommending that the transaction be cleared subject to negotiation of undertakings to address other concerns.

[9] *UK Competition Commission (2003): Centrica plc and Dynegy Storage Ltd and Dynegy Onshore Processing UK Ltd: A report on the merger situation, (CM 5885). The Lexecon paper submitted to the CC forms an annex to the report*

[10] *Case No COMP/M.1672*

Example: Volvo/Scania [10]

An early example of the use of merger simulation in Europe was in the proposed merger of Volvo and Scania, two Scandinavian producers of heavy trucks, a merger ultimately prohibited by the European Commission. The proposed merger would have led to significant increases in the parties' market shares in several EU countries, particularly in the Scandinavian countries where the parties' combined markets shares would have been relatively high.

The Commission retained outside economists to estimate demand elasticities for the main heavy truck brands in each EU country, and then used these estimates to simulate post-merger price increases. The estimated elasticities confirmed that Volvo and Scania heavy trucks were relatively close substitutes for each other, while rival suppliers' heavy trucks were less close substitutes for both Volvo and Scania heavy trucks. As a consequence, the results of the merger simulation suggested that the merger would have substantial unilateral effects, with the prices of both Volvo and Scania trucks increasing by about 5% in many EU countries and by more than 10% in the Scandinavian countries. The prices of rival suppliers' heavy trucks were largely unaffected by the merger. The Commission's merger simulation analysis was strongly contested by the parties on grounds that the data had serious limitations.

Example: Interstate Bakeries/Continental Bakeries [11]

This proposed merger would have brought together the leading bakers of branded white pan bread in several geographic markets in the US. The US Department of Justice (DoJ) was concerned that following the merger, the merging parties would be able to raise the prices of some of their white bread brands. As part of its investigation, the DoJ used retail price data to estimate demand elasticities for the main brands of white bread in two geographic markets, and used these estimates to simulate the effects of the merger. The results of the simulation showed that the proposed merger would have allowed the parties to substantially increase the prices of their brands. On the basis of this evidence, along with other evidence which suggested that the merger would significantly reduce competition, the DoJ filed a case against the merger. This led the merging parties to offer substantial divestments to allay the DoJ's concerns.

7.3 Complications

The attraction of merger simulation is that it provides estimates of the effects a merger will have on prices and outputs. This is in contrast to the standard approach to merger assessment where the size of these effects is rarely quantified but is instead inferred, often on the basis of the combined market shares of the merging parties. This can be a poor indicator of the parties' market power, particularly in differentiated product markets. Also, merger simulation allows the offsetting effects of efficiencies and divestments to be systematically and explicitly taken into account in the assessment of a merger.

However, the results of merger simulation critically depend upon the accuracy and reliability of the estimated demand elasticities and the assumption made about the nature of competition. If either of these factors does not accurately reflect economic behaviour in the industry, then the results of the merger simulation will not be informative.

Estimated demand elasticities

As discussed in Chapter 4, using econometrics to estimate accurate and robust demand elasticities requires long data series and can raise a number of technical issues. If the alternative approach of making a strong assumption about the structure of demand is used to estimate the demand elasticities, then the analyst needs additional evidence to justify this assumption otherwise the elasticities may not reflect actual consumer behaviour.

The nature of competition

The assumption made about the nature of competition also needs to be justified by other evidence on the industry. For example, if Bertrand competition (competition in prices) is assumed, then evidence showing that price is the key strategic variable is desirable. One way of checking whether the estimated demand elasticities and the assumption about the nature of competition are reasonably accurate is to compare the price-cost margins estimated in the merger simulation with actual price-cost margins. If these are similar, then this suggests that the demand elasticities and the competition assumption capture the key aspects of consumer and firm behaviour in the industry, and hence that the results of the merger simulation are informative.

7.4 Conclusion

Merger simulation is a technically demanding approach, which can require a large amount of data to produce meaningful estimates of the unilateral effects of a merger. In the light of some of the technical ambiguities associated with the modelling involved, merger simulation alone should not be relied upon to assess the competition issues associated with a merger; it should be considered as a complement to existing techniques. However, it does quantify the likely effects of a merger, and it clearly identifies the economic factors that generate these effects. For these reasons, the use of merger simulation is growing in Europe.

8 Price/concentration analysis

8.1 Introduction

Price/concentration studies examine the relationship between price and the level of concentration. Such analyses can give an insight into market definition and can also be used to infer the likely effect of a merger on prices. The intuition behind the approach is that higher concentration in a market is frequently assumed to be associated with greater market power. This market power leads to higher prices, so higher levels of concentration might be expected to coincide with higher prices. However, if there are sufficient constraints on the ability of firms with high market shares to exercise market power, higher concentration does not necessarily lead to higher prices.

8.2 The basis of the approach

Price/concentration studies are particularly useful where data are available for a number of distinct geographic areas with varying concentration levels and the alleged problem arises in only one (or a few) of these areas. The basis of the test is to compare prices in the different markets in order to see whether those markets in which concentration is higher tend also to be those in which price is higher. It works best when the candidate market being tested is the narrowest plausible definition available. If a relatively broad definition is being tested, then the absence of a relationship between price and concentration may not help in deciding whether the relevant market should be defined more broadly or more narrowly.

In a merger case, if there appears to be no systematic relationship between price and a wide range of concentration in a narrowly defined candidate market, then this is consistent with the view that the merger is unlikely to lead to higher prices as a result of the increase in concentration. Equally, if there appears to be a positive relationship between price and a wide range of concentration (i.e. price is systematically higher where concentration is higher), this suggests that the merger may lead to higher prices. In a dominance (Article 82) case, evidence of the absence of a relationship between price and concentration suggests that a high market share in that candidate market does not bestow market power.

This type of analysis can also be extended to see whether specific rivals are particularly important competitive constraints on a firm, for example, because the firms' products are closer substitutes. This involves examining whether the firm's prices tend to be significantly lower in areas where it directly competes with a specific rival or where the rival has a large share of sales – if prices are significantly lower, then this suggests that this rival is a particularly significant competitive constraint on the firm. This type of analysis can be used to see if the parties to a merger are particular important competitive constraints on each other, as well as more generally to identify which rival firms provide the main competitive constraints on a firm. It can also provide evidence on the issue of geographic market definition by, for example, assessing whether the distance between local rivals has a material effect on prices.

Under certain circumstances, it is appropriate to measure not the wholesale or retail price but rather the margin being earned by the suppliers under investigation (with margin defined as the extent to which prices exceed costs). In particular, if unit costs vary markedly across regions, a margin/concentration analysis could be more reliable than a price/concentration analysis. More generally, margin data are desirable in order to control for both cost differences and product characteristics.

Example: Reed Elsevier/Harcourt [12]

Price/concentration studies can sometimes take more sophisticated forms, depending on the specific circumstances of a case. During the investigation of the Reed Elsevier/Harcourt merger in 2001, Lexecon undertook an econometric analysis of the price impact of past mergers. This was done in response to an existing study, which suggested that previous mergers of commercial academic publishers had systematically resulted in higher prices.

Replicating the methodology of the other study but using a larger dataset of academic journals, Lexecon examined whether the evidence confirmed the existence of a systematic link between mergers and price rises. The method consisted of identifying changes in the pricing behaviour of merging publishers that were not explained by the underlying pricing trends observed in the industry. In other words, the econometric model estimated the 'merger effect' by calculating the difference between the average price changes of merging publishers and the average price changes of non-merging publishers.

Our analysis suggested (see Chart 8.1 below) that prices did not display a systematic tendency to rise following a publishing merger. Hence the conclusion that academic publishing mergers always led to price rises was not valid. The UK Competition Commission cleared the merger.

**Chart 8.1: Estimated average 'merger effects'**
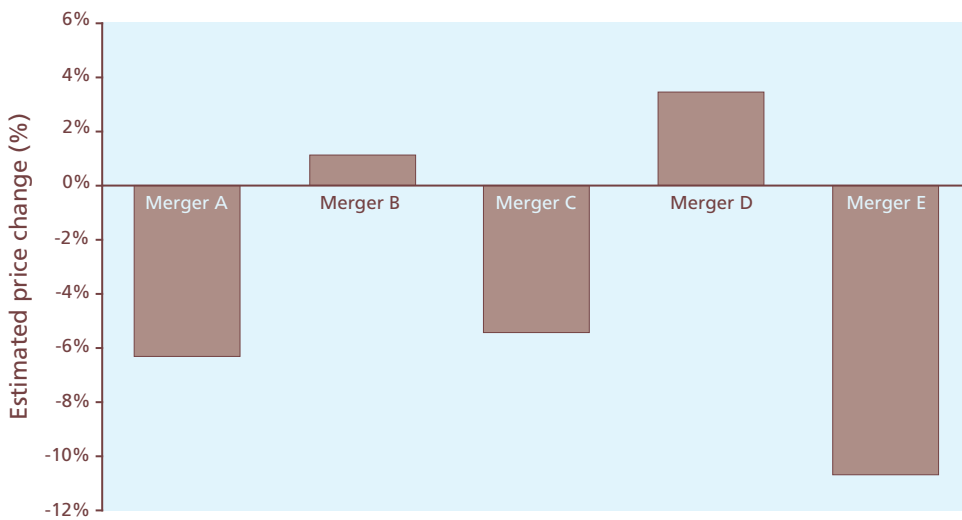
Example: A retail merger

In a recent merger involving two retailers, Lexecon used a variant of price-concentration analysis to examine whether the merging parties were particularly important competitive constraints on each other. The proposed merger occurred in a retail sector where there were important local aspects to price competition and where there was substantial variation in the presence of rival retailers across local areas. To see whether the merging parties were particularly close rivals, Lexecon examined whether the acquiring retailer's prices were significantly lower in areas where the target retailer had a presence, compared with areas where the target retailer did not have a presence. This was done using regression analysis, so that we could control for other reasons why prices might vary across different areas – for example, differences in local costs. We also used different definitions of the local areas to ensure that the results of our analysis were robust. The results showed that the presence of the target retailer had no significant effect upon the prices charged by the acquiring retailer. This evidence supported the argument that the merger would not remove an important competitive constraint on the acquiring firm.

[12] UK Competition Commission (2001): Reed Elsevier plc and Harcourt General, Inc: A report on the proposed merger (Cm 5186)

Example: Surgical products (Nordic Capital/Mölnlycke/Kolmi) [13]

Lexecon carried out a price/concentration analysis in the merger of Mölnlycke Clinical Products and Kolmi – two manufacturers of hospital products such as surgical gowns and bandaging. The Commission had to consider whether the relevant geographic market was wider than individual member states. Lexecon examined whether there was any positive statistical association between national market shares and the level of both prices and margins in each country, after controlling for differences in distribution and marketing costs between countries. In total, 30 data sets examining the link between various definitions of price or profit and concentration were tested. Chart 8.2 below illustrates one example (product details have been removed and the labelling of countries has been changed for reasons of confidentiality). The high degree of dispersion of data points illustrates the absence of a systematic relationship between price and concentration.

Chart 8.2 Illustrative price/concentration results
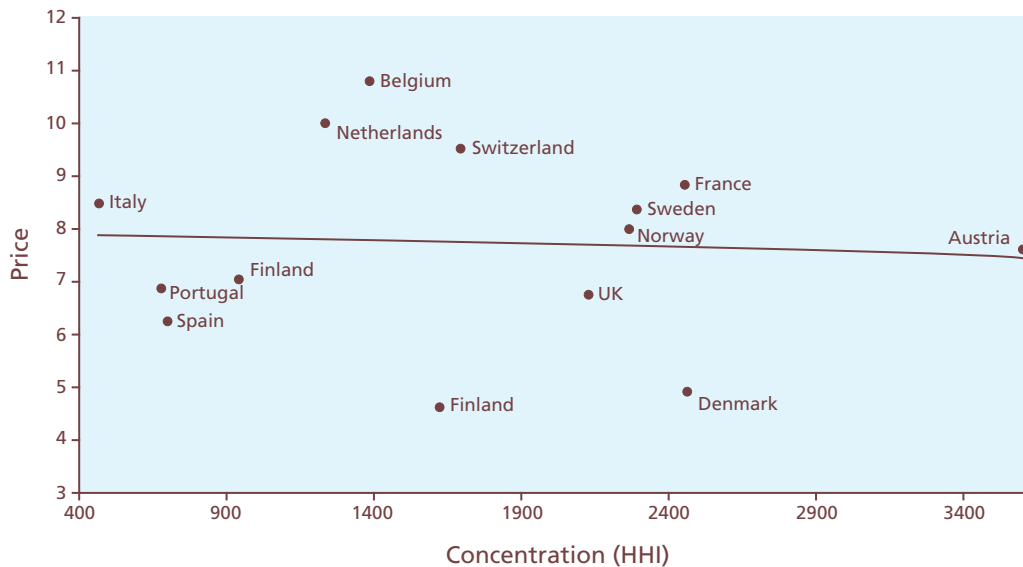
Overall the results of the analysis showed that there was no clear evidence of a positive association between price or profit and the various measure of national concentration for any of the products.

8.3 Complications

As with most techniques, price/concentration studies can be carried out at varying levels of sophistication. The level of sophistication used is usually driven by the nature of the data available. The following general issues should be considered when undertaking price/concentration analysis.

Interpreting the results of price/concentration studies

One of the appealing features of a price/concentration study is that there is usually no need to reach a definitive explanation for the absence of a link between price and concentration in the narrowly defined candidate market. Broadly speaking, there are two reasons why concentration might not be related to price in a candidate market: the relevant market is wider than the market in which concentration has been calculated; or the market definition is correct but there are other constraints on the exercise of market power (such as a high degree of supply-side substitutability or low entry barriers). Usually, it is not necessary to decide which of these explanations is the correct one.

Choice of concentration ratio

The standard measure of concentration used in anti-trust analysis is the Herfindahl Hirschman Index (HHI). The HHI is a way of collapsing the different market shares of all the suppliers in a market into a single indicator. It is calculated as the sum of the squares of all the individual market shares. Arguably, if the price/concentration analysis is being used to investigate the possibility of single firm dominance then the market share of the firm under investigation might also be an appropriate measure of concentration.

Choice of price

It is important to compare 'like with like' when undertaking a price/concentration analysis. Ideally, the product whose price is being compared should be identical across all regions under investigation, otherwise price disparities might be due to differences in the characteristics of the products rather than differences in supplier market power. For that reason, it is often preferable to undertake the analysis with margin data – which directly controls for differences in costs and product characteristics – if the product's features vary or if there are reasons to believe that production costs are substantially dissimilar across the markets in the sample. If products are heterogeneous or if a number of products are under investigation, some adjustments can be made. For example, if more than one product is subject to scrutiny, a price index can be constructed (or possibly, a volume-weighted average).

8.4 Conclusions

Price/concentration and margin/concentration analyses have the attraction that powerful results can be achieved with simple data. In their simplest form, only data for price, margin and market share is needed for as large a sample as possible; results will be more robust with larger samples. Similarly, if concentration varies markedly across the regions sampled, the results will be more compelling.

9 Shock analysis

9.1 Introduction

Shock analysis is based on the idea that a significant change in a market can provide the basis for a natural experiment. A change, especially a sudden and unexpected change, to either supply or demand can give a key insight into the competitive conditions in a market on the basis of how customers and/or competitors have reacted to the event. This type of analysis can play a central role in defining relevant product and geographic markets. It can also identify the extent to which two merging firms are close competitors.

9.2 The basis of the approach

The basis of the approach is that consumers' and producers' reactions to certain events – particularly unanticipated events – can reveal much about the nature of competition in a market. Such shocks cover a wide array of possible events: they include strikes, unexpected plant shutdowns, stock shortages, promotion and advertising activity, trade frictions, sudden exchange rate movements, technological change, market entry and regulatory intervention. All of these shocks can give rise to sudden shifts of supply or demand in a market. Shocks can affect a range of industries (for example, changes in the exchange rate will affect a large number of markets) or they can be market or firm specific (for example, an unexpected plant shutdown).

In contrast to other quantitative techniques, it is hard to define a general methodological approach as much depends on the specifics of the shock in question. The following examples illustrate how shock analysis has been applied in some recent competition cases.

Example: price promotions in a fast moving consumer good market

In several cases, Lexecon has analysed the impact of price promotions to provide an insight into market definition and the closeness of competition between merging brands. One example involved using a 'buy one get one free' ('BOGOF') promotion to provide evidence on product market definition. BOGOFs involve significant price reductions; for example the price reduction on a basic BOGOF is 50%. Therefore, we would expect a BOGOF promotion of a product to have significant negative effects on the sales of products that are close substitutes for the product that is being promoted.

The question in this case was whether a 'low fat' version of a product competed with the 'regular' version of the product – since this case is confidential, we use yoghurt to illustrate the analysis. As there had been a recent 'three for two' price promotion on low fat yoghurt over a number of weeks, we examined what effects this reduction in the price of low fat yoghurt had on the sales of regular yoghurt and other rival products such as fromage frais – the prices of these rival products were constant over the period.

Chart 9.1 plots the price of low fat yoghurt and sales of regular yoghurt for the period August 2002 to August 2003. The BOGOF on low fat yoghurt occurred in February and March 2003.

Chart 9.1: How low fat prices affected regular volume
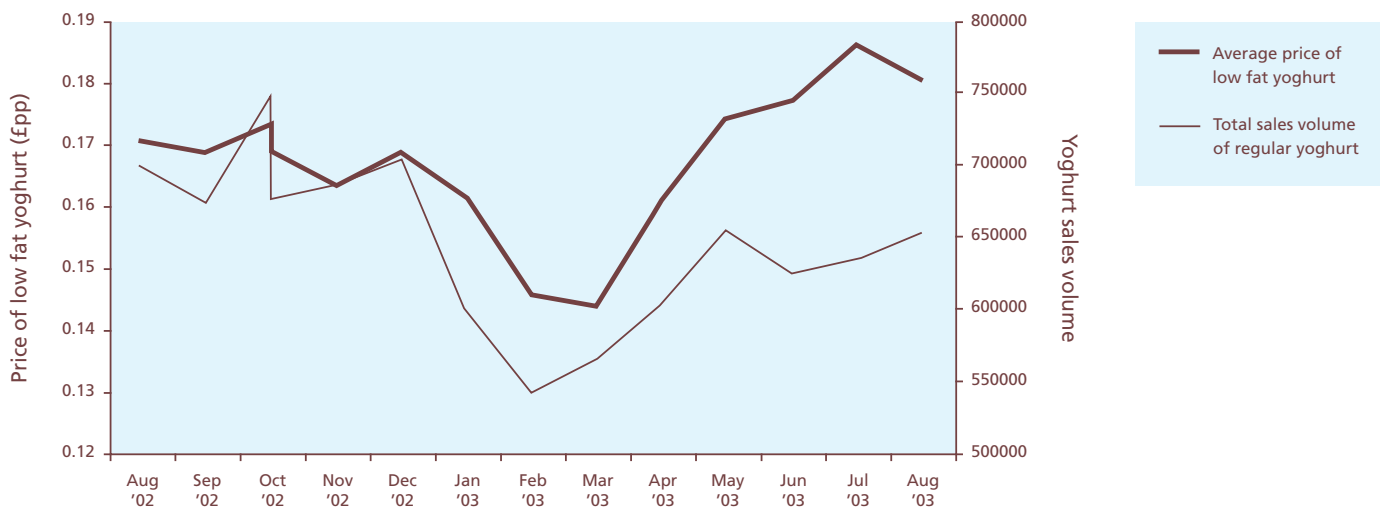
The figure shows that the promotion on low fat yoghurt led to a significant reduction in the sales volume of regular yoghurt. However, we found that there was no similar significant reduction in the sales of other broadly similar products, such as fromage frais. The results suggested that low fat and regular yoghurt were in the same market, but that this market was not wider than all yoghurt. This illustrates how the impact of promotional activity can provide useful insights into market definition. Note that care needs to be taken in interpreting results from such offers, as in some markets it is possible that volume changes could be related to stocking behaviour rather than substitution (although this was not an issue in the above case).

Example: Kimberly Clark/Scott [14]

The merger of Kimberly Clark and Scott provides an example of how exchange rate movements can give an insight into market definition. At issue was the relevant geographic market for household tissues of various kinds, particularly toilet tissue and facial tissues. The Commission considered the question of whether the relevant market was wider than the UK. If the market genuinely was Europe-wide, the exchange rate shock in 1992 (when sterling left the exchange rate mechanism) would have led to an expansion of supply from the UK to the Continent and contraction of supply from the Continent to the UK. Both of these effects would have brought prices back into line within a relatively short period of time.

However, the analysis of price movements across countries showed that the relatively high price of German household tissues persisted long after the exchange rate shock, with no visible tendency for the prices to come back into line with those in the UK. Under these circumstances there was no evidence to suggest that there was a Europe-wide household tissue market. The shock analysis suggested that there were strong grounds for considering the relevant market to be national.

[14] Case No IV/M.623, OJ L183

Example: The opening of new restaurants

How a firm responds to the behaviour of rival firms can also provide the basis for shock analysis. In a recent confidential case in the restaurant sector, Lexecon examined how the outlets of a restaurant chain responded to new entrants in their local markets. Specifically, we analysed how the sales and prices at our client's restaurants were affected by the opening of different types of rival local restaurants. This analysis was undertaken using regression analysis, so that we could control for other factors that might affect the sales and prices at these outlets. We also used the outlets of the chain that were unaffected by the opening of new local restaurants as a control group. The results of the analysis showed that while the openings of some types of restaurants did not have a material effect upon sales or prices at our client's competing outlets, the openings of certain other types of restaurants did have a material effect. Moreover, the size of these effects on the sales and prices at our client's competing outlets was not significantly smaller than the effects that were found when restaurants of the same type as our client opened in the vicinity of one of our client's restaurants. Overall, these results suggested that the product market was wider than the particular type of restaurant, but not as wide as all restaurants.

9.3 Complications

Shock analysis can take many forms, so there are few general rules that can be applied when undertaking this technique. Generally speaking, a shock analysis is most effective when a clearly identified event of significant magnitude has affected the market at a time when no other major changes were taking place. Indeed, it is essential to be certain that the effect being identified is attributed to the correct cause. For example, when relative prices in an industry change at the same time as entry occurs it cannot always be assumed that entry was the sole driving force behind the relative price change. As in all cases, the specific circumstances of the industry need to be examined and a shock analysis needs to incorporate the impact of any other factor that might explain the observed patterns. As the examples cited above illustrate, shock analysis tends to provide supportive supplementary evidence to augment more conventional market analysis.

9.4 Conclusion

The attraction of shock analysis lies in its intuitive nature and the fact that it is undemanding in terms of data requirements. Shocks can appear in a number of forms, and there are few industries in which the participants and the competitive environment have remained unaffected by external events. Shock analysis shows that quantitative techniques need not be overly complex to be effective.

10 Bidding studies

10.1 Introduction

In situations in which competition takes the form of bidding for individual contracts, bidding studies can give a key insight into the likely impact of a merger on competition. Such studies can help to identify both how many firms are required for bidding to produce a competitive outcome and the extent to which two merging firms are close competitors.

10.2 The basis of the approach

In many industries, firms purchase services or products through a bidding system. Often, the services or products involved are so highly specific that there is no concept of a market price for the contract and instead tenders are tailored to the specified requirements of each client and each project. In these markets, market shares are frequently poor indicators of market power, as the shares reflect past success and firms do not have to have won many bids in order to be a competitive constraint. Moreover, the 'all or nothing' characteristic of such markets implies that there are usually strong incentives to win tenders (in particular when the size of the tender is high relative to the size of the bidder and when new tenders are infrequent).

Bidding studies can be used in a number of ways. They can be used to examine how the number of bidders affects the prices of contracts. This analysis can provide evidence on how the reduction in the number of bidders arising from the merger will affect prices in the market. Bidding studies can also be used to examine the extent to which two merging firms have competed against one another in the past and, if data permits, the number of times these two firms have offered the two most competitive bids. If the two firms competed frequently in the past, then a merger of the firms should raise more concerns than if competition between the firms has been infrequent. Quantitative studies of behaviour in such markets can also help to evaluate the discipline provided by new firms on the competitive behaviour of incumbent firms in the market.

The following cases provide different examples of how bidding studies can provide useful results.

Example: Helicopter services [15]

In 1999, a merger between two providers of helicopter services to offshore oil and gas facilities in the UK Northern Zone of the North Sea would have created a duopoly. One of the merging parties was also providing its services in the Norwegian Northern Zone of the North Sea where only two operators were present. Lexecon undertook a comparison of gross margins on contracts in the UK Northern Zone (where 3 operators were active) and in the Norwegian Northern Zone (where only 2 operators were active). The analysis showed that between 1995 and 1998, margins were very similar in both areas, and this result was consistent with the view that the creation of a duopoly in the UK Northern Zone would not lead to a reduction of competition. The UK Competition Commission cleared the transaction.

Chart 10.1: Margin per flying hour (Norway 1995 = 100)
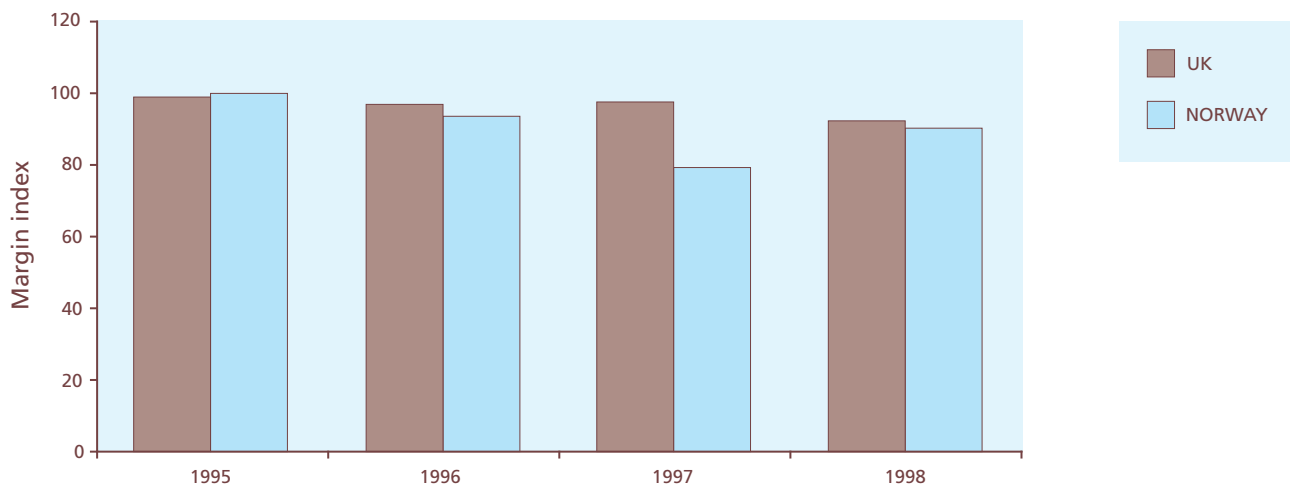
Example: Price Waterhouse/Coopers & Lybrand [16]

A central issue in the merger of Price Waterhouse and Coopers & Lybrand was whether a reduction in the number of large accountancy firms from six to five would have a detrimental impact on competition. The European Commission examined a number of indicators including the results of bidding studies. Lexecon contributed to the analysis of audit tenders which revealed that most clients asked either three or four of the six large firms to submit bids. As a result, the Commission accepted that a reduction in the number of feasible bidders from six to five would not adversely affect client choice. Bid analysis also revealed that each of the remaining four accountancy firms was able to win business from both PW and C&L.

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[15] *UK Competition Commission (2000): CHC Helicopter Corporation and Helicopter Services Group ASA: A report on the merger situation (Cm 4556)*

[16] *Case No IV/M.1016, OJ L50*

Example: A utility merger

In the context of a potential merger in a concentrated utilities market, Lexecon undertook a bidding study to advise the acquiring company on the antitrust risks associated with the transaction. The study of past bids indicated that the merger was likely to raise serious issues in view of the strong link between the number of bidders and the bid price (in particular, the data consisted of the bid price and expected costs, thus providing the margin the bidder was hoping to gain on the contract). Chart 10.2 is a stylised version of the results of the study.

Chart 10.2: Average margin and number of bidders
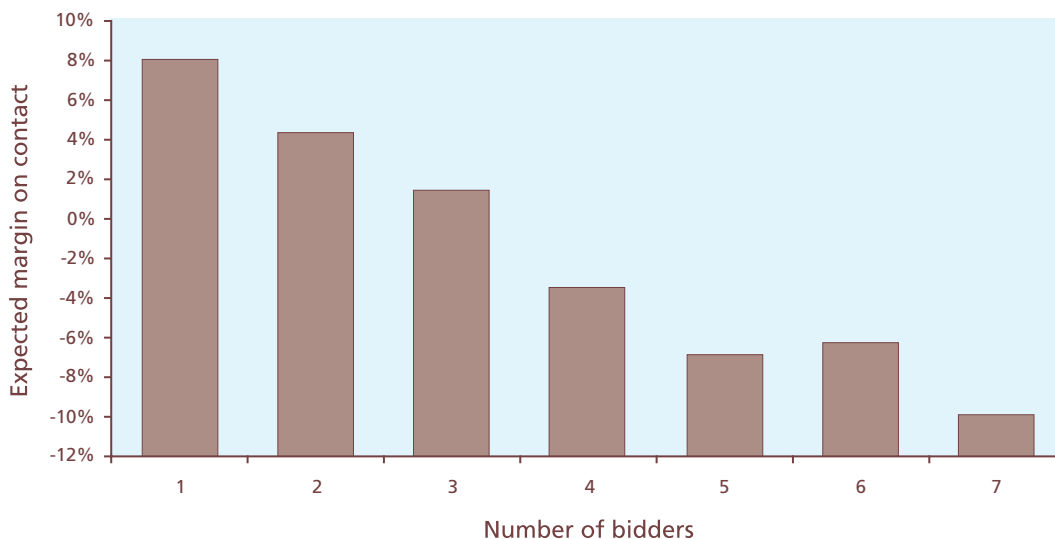
The chart shows a strong (and statistically significant) negative relationship between the number of bidders and the expected margin. As part of the exercise, we also investigated whether the participation of the target company had a significant impact on the price. This suggested that margins were even lower when the target was part of the bidding process (for example, in cases where there were three bidders, the expected margin was lower when the target was a bidder relative to when it was not a bidder). In the light of this analysis and other work which suggested that the merger would be problematic from a competition perspective, the proposed transaction was abandoned.

10.3 Complications

One of the attractions of bidding studies is that they can reveal useful information about the competitive interactions in a market without the need for a large amount of data analysis. However, more detailed data can reveal quite specific information on the extent to which firms compete in a market.

Allowing for differences in contract specification

A common feature of bidding markets is that contracts are specifically tailored to each customer's requirements. Therefore, to be able to compare the prices of different contracts it is necessary to control for the differences in the specifications of the contracts. This can require a lot of data. One way of at least partially controlling for differences in contract specification is to analyse margins rather than prices, as this allows for the differences in costs generated by the differences in contract specification.

The number of competitors

Assessing the number of bidders can also be problematic. In some instances, clients prefer to negotiate with a selected supplier, with the implicit threat that they could turn to another supplier if they are not satisfied with the terms on offer. The other potential suppliers may be affecting the terms of the negotiation even though they are not technically 'bidding'. For all these reasons, the bidding analysis needs to be carefully tailored to the specifics of the industry under scrutiny.

Estimating price rises

An analysis of how often the merging firms are the lowest price bidders can offer more evidence on the degree of competition and may even provide estimates of how much prices would rise as result of the merger. A simple study of the bids alone can be useful but could be misleading if quality, reliability, or speed of completing a contract can vary across tenders. Statistical tests can yield insights into the impact of one of the merging parties on other bids even if the sale does not necessarily go to the lowest bidder.

The effect of entry

A qualitative study of past entry can be useful in evaluating the ease with which further entry is possible, and can be particularly important in a bidding market because of an entrant's potential impact even before making any sales. Simple descriptive tables that summarise past entrants' experiences and the speed with which they were able to bid on contracts, even without making sales, can indicate whether entry is likely to be sufficiently rapid to impose a constraint on pricing.

10.4 Conclusion

Bidding studies can produce useful results in situations in which competition takes the form of bidding for contracts. In particular, bidding studies can be used to investigate how many firms are required for competitive outcomes and the extent to which two merging firms are 'close' competitors.

11 Damages assessment

11.1 Introduction

A key issue in many commercial litigation disputes is the assessment of the damage resulting from the actions of one of the parties. Similarly, in cases where anti-competitive conduct has led to consumer detriment, the size of this consumer harm can be an important issue; for example, it may influence the size of any fine. Lexecon uses a variety of techniques to estimate damages in commercial litigation disputes and increasingly has been applying these techniques in competition cases. In this chapter we illustrate how damages can be estimated using the example of price fixing of a product sold to final consumers. However, the general approach outlined could be applied to other areas where anti-competitive behaviour has resulted in a distortion of competition.

11.2 The basis of the test

The general approach to damages assessment is to compare the actual outcomes with estimates of what the outcomes would have been 'but for' the actions of the offending party or parties. In the case of price fixing involving a product sold to final consumers this involves comparing the prices actually observed during the period of alleged collusion with estimates of the prices that would have resulted 'but for' the alleged collusion.

A major challenge in assessing damages is estimating what would prices have been "but for" the alleged collusion/price fixing. There are a number of ways in which the 'but for' prices can be estimated. If it is known when the collusion was alleged to have started, then a simple comparison of prices during the period of alleged collusion with the prices in the period before or after can often be highly informative. Alternatively, it may also be possible to compare prices in areas (or to customers) where collusion is alleged to have occurred with prices in areas (or to customers) where it is accepted that collusion did not operate. A complete analysis of price-fixing damages, however, will usually require the 'but for' prices to be econometrically estimated, as this allows the analyst to control for the main factors that affect prices – for example, changes in costs, demand and customer mix.

The regression equation is estimated using data not affected by the alleged collusion. For example, in a 'before and after' study, the equation is estimated using data from a time period during which it is believed that the collusion was not operating. In other studies, the regression model may be estimated using data from an area that is believed to be free from collusion. Once the equation is estimated, the coefficients from the estimated model are then combined with the values of the explanatory variables during the period of (or in the area of) collusion to generate estimates of the 'but for' prices: i.e. what prices would have been if the collusion had not been operating.

Example: Vitamins Cartel 1989-1999 [17]

In 1999, Hoffmann-La Roche, BASF and a number of other vitamin producers entered guilty pleas in the US to charges of operating a worldwide cartel covering most of the main vitamins from 1989 to 1999 (the scope of the cartel varied over time). The cartel was also the subject of an Article 81 investigation and the Commission's Decision gives an account of the workings of the cartel.

The cartels in vitamins A and E were amongst the most important and lasted from September 1989 to February 1999. Chart 11.1 below shows price indices for vitamins A and E over the period 1989 to 2000.

Chart 11.1: Prices of vitamin A and vitamin E
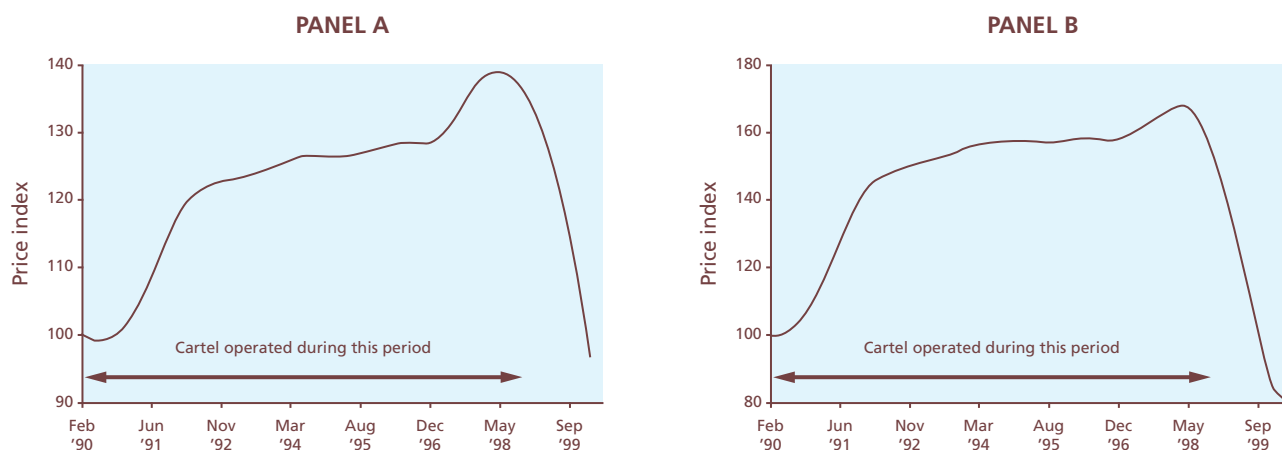
The Commission Decision describes how the rapid price increases that occurred in 1990/91 for both vitamins A and E (panels A and B, respectively) were the outcome of a series of cartel meetings at which price increases were agreed. High prices were maintained for the period of the cartel, and at the end of the cartel (after intervention by the US authorities) prices fell substantially. In this case, a simple examination of actual prices indicates that the cartel had a significant effect upon prices, and hence that the effects on consumers were substantial.

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[17] *Commission Decision COMP/E-1/37.512*

Example: Polypropylene carpet

Polypropylene carpet is low-grade, inexpensive carpet that is used in low-income housing and in offices. In this case, which was brought in the US, it was alleged that US producers colluded during the mid-1990s, but that the collusion broke down in the late 1990s when it became known that the Justice Department had launched a price-fixing investigation. There was considerable debate in the civil case over the use by the plaintiffs' expert of price-cost margins as the dependent variable. But even when price was used as a dependent variable (and cost included as one of the explanatory variables), most specifications indicated that actual prices during the period after the alleged collusion broke down were slightly lower than predicted by a regression model estimated in this case (for data availability reasons) on data from the period of alleged collusion. Taken at face value, this finding would seem to support the allegation of collusion.

Closer analysis of the data, however, suggested a potential problem with this interpretation. During the period of alleged collusion, the price of the principal input for polypropylene carpet was generally on the decline. These declines in input costs were not passed through dollar-for-dollar, but the data showed that the defendants evidently felt competitive pressure to pass through quickly a high percentage of these cost declines. It so happened that, just at the time when the alleged collusion broke down, the price of the main input soared – to levels that had not been observed since the very start of the period of alleged collusion.

The data showed that this increase in input costs was not passed through as fully or as quickly, compared with the pass-through rates during the period of alleged collusion when input costs were falling. The defendants suggested that this was further evidence of the competitiveness of the industry: prices were quick to fall when input costs were declining, but concerns about losing sales to competitors meant that prices were slow to increase when input costs were on the rise. This pattern is in contrast to the usual pattern in oligopolies in which cost increases tend to be passed through more quickly than cost decreases.

Because the case settled before trial, this issue was not adjudicated. But the question was well framed. Were the lower prices during the 'post collusion' period relative to the prices predicted by the regression models an indication of collusion breaking down? Or instead were the lower prices relative to the predicted level a by-product of a structural change in the relationship between price changes and cost changes that happened to coincide with the alleged breakdown of collusion? The issue of structural change is a complication discussed overleaf.

11.3 Complications

Since the assessment of damages often involves econometrically estimating how prices would have evolved in the absence of price fixing, a robust analysis requires both a solid understanding of the relevant industry and a rigorous approach to statistical analysis. As discussed in Chapter 4, this type of econometric analysis raises various data and technical issues. In particular, we would highlight the following issues.

Including all relevant variables

As in any econometric analysis, it is important to have a well-specified equation. In the context of a price-fixing analysis, this means that it is important for the team undertaking the analysis to understand how the market in question works in order to ensure that all relevant variables are included in the regression equation. For example, a standard analysis would require information on prices, costs, competitors, capacity, output and capacity utilisation. However, it may be difficult to obtain long and consistent data series for all of these variables.

Structural change

An analysis that uses data from one period to estimate a model that will be used to predict 'but for' prices in another period assumes implicitly that the price-setting process would have been the same in the two periods but for the collusion. For example, if a 10% change in cost in the estimation period tended to result in an 8% change in price, then the usual method of estimating damages would assume that in the period of collusion a 10% change in cost likewise would have led to an 8% change in price but for the collusion. This assumption is frequently benign. But, as suggested by the polypropylene example cited above, there are situations where this assumption may be problematic.

Price-cost pass-through

Unlike in the United States, where anti-trust damages are based on excess pricing, in Europe they may be based on actual damage to the buyer. These differ when the buyer is not the final consumer, but an intermediate producer, as an intermediate producer may be able to pass though part or all of the cost increase to its downstream customers. To estimate the actual damages to a customer who is an intermediate producer, it is necessary to estimate how much of the cost increase the intermediate producer was able to pass-through to their downstream customer. This can be done by using regression analysis to estimate the effect of cost changes on prices in the downstream markets. However, this adds a substantial extra complication to the assessment of damages.

11.4 Conclusion

The assessment of damages in competition cases draws on established statistical techniques, frequently involving the use of regression analysis to estimate how prices would have evolved in the absence of the alleged anti-competitive behaviour. As the description of the application of damages assessment to price fixing set out in this chapter shows, specification of the regression model is critical. This, in turn, requires that the team conducting the econometric analysis develops a solid understanding of the relevant industry. It is also important in this kind of analysis to step back and consider alternative explanations for econometric results; in particular, whether the results may be the product of a structural change in the relationship between price and the explanatory variables not captured by the regression model.

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