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Econometric analyses of unilateral effects in merger cases

Abstract

Econometric analyses such as demand estimation and reduced form price analysis are increasingly being used in Europe by both competition authorities and the merging parties to provide direct evidence on the unilateral effects of mergers. Unlike most other evidence and analyses used in merger assessment it is possible to objectively assess the robustness and statistical reliability of econometric analyses, and this is a major issue in every merger case that involves such analyses. However, since any econometric analysis involves dealing with a range of complex methodological issues, it is almost always possible to identify some limitations with the analysis. These limitations should not be used to dismiss the analysis in its entirety, but should determine how much weight is placed on the analysis in the merger assessment.

Introduction

1. The use of econometric analysis in European merger cases has increased substantially during the last decade. Both the merging parties and competition authorities now regularly attempt to use econometric analyses such as demand estimation and reduced form price analysis, to provide evidence on the possible effects of mergers and to test the plausibility of the theories of harm. Econometric analysis has largely been used to assess the possible unilateral effects of a merger rather than the possibility of coordinated effects. This is partly because unilateral effects are more susceptible to econometric analysis than coordinated effects, but it also reflects the increased focus on unilateral effects in European merger control over this period, especially in recent years.

2. This increased usage of econometric analysis has, however, not been uncontroversial. Econometric analyses involve making assumptions about consumer or supplier behaviour. They also depend upon the quality and properties of data used, and, as with any econometric analysis, it is possible to assess the robustness and statistical reliability of the results. This means there is almost always considerable scope for, and often is, a detailed debate between the two sides' economists about how changes to assumptions, data and econometric technique affect the results and how reliable are the results, often with one side appearing to merely try and undermine the analysis of the other side. As a consequence the results of econometric analyses can be viewed sceptically, especially by non-economists.

3. This article assesses the increased usage of econometric analysis by reviewing the main such analyses used in recent European merger cases – demand estimation, a variant of it known as residual demand estimation, and reduced form price analysis. It discusses how these econometric analyses can be used to provide direct evidence on the possible unilateral effects of mergers, and what are the key assumptions, data requirements and econometric issues that help to determine the robustness and reliability of these analyses. To illustrate how these econometric analyses have been used in merger cases, it also looks at three recent European merger cases where they have been used; *Friesland Foods/Campina* where the Commission used demand estimation, *INEOS/Kerling* where the Commission attempted to estimate the residual demands of the merging parties and *Ryanair/Aer Lingus* where reduced form price analysis played a major role in the Commission's decision to prohibit the merger.

4. Overall the increased usage of econometric analyses in European merger cases should be welcomed, as the results of such analyses can help to improve the quality of decision making in merger cases. Providing the necessary data are available both demand estimation and reduced form price analyses can be used to provide direct evidence on the key unilateral concerns in a merger. Moreover, unlike many other types of analysis and evidence used in merger assessment, it is possible to assess how robust and reliable are the results of the econometric analysis. As a consequence this has been a major issue in every merger case where such analyses have been used. Clearly the robustness and reliability of econometric analyses are important, as such analyses only improve the quality of decision making in merger control if they provide robust and statistically reliable results. However, at the same time it also needs to be recognised that econometric analyses are unusual in that it is possible to assess the robustness and statistically reliability of them in an objective manner. Moreover, given the number of methodological issues involved in econometric analyses it is almost always possible to

find some limitations with these analyses. However, just because an econometric analysis suffers from some limitations does not mean that the results of the analysis should be entirely dismissed. Instead, any limitations should determine how much weight should be placed on the results in the merger assessment.

I. Demand estimation

5. The most direct way of using econometrics to address the possible unilateral effects of a merger is to estimate a demand system. Typically this analysis is applied in a differentiated products market, where it may be difficult to define the market with any precision and market shares are less informative about the closeness of competition between different branded products. The analysis involves estimating a demand equation for each of the main brands in the market to give estimates of the own-price elasticity of this brand and the cross-price elasticities associated with the prices of competing brands: the own-price elasticity shows by how much demand for a brand changes when its own-price changes by 1%, and the cross-price elasticity shows by how much its demand changes when the price of a competing brand changes.[1]

6. Once the own-price and cross-price elasticities have been estimated, they can then be used to assess the key unilateral concerns of the merger: i.e. whether the merging parties' brands are particularly close competitors of each other compared with third parties' brands, and what will be the main competitive constraints on the merging parties' brands following the merger. This can be done by comparing the cross-price elasticities between the merging parties' brands, with the cross-price elasticities between the merging parties' brands and third-party brands. If the cross-price elasticities between the merging parties' brands are materially larger than those with other third party brands, then this suggests that the merging parties' brands are particularly close competitors, and hence the merger is likely to lead to an increase in prices. Conversely, if the cross-price elasticities between the merging parties' brands are smaller then those with third party brands then this suggests the merging parties' brands are not particularly close competitors so the merger is unlikely to lead to an increase in prices.

7. More formally the estimated own-price and cross-price elasticities can be used to assess the possible unilateral effects of the merger by estimating the possible price effects of the merger.[2] These price effects can be estimated either by using the estimated elasticities to calculate the diversion ratios between the merging parties' brands or by using them in a merger simulation model.[3] The diversion ratio from one brand to another is the proportion of sales a brand loses to that rival brand when its price increases,[4] so it is depends upon the ratio of the cross-price elasticity to the own-price elasticity.[5] The larger the diversion ratio between two brands is, the larger the percentage of sales a brand loses to that rival brand following an increase in its price, and hence the greater the price increase if these brands merge. Alternatively, this can be done by using the estimated own-price and cross-price elasticities in a merger simulation model to estimate the price effects of the merger. Again, the greater the proportion of sales a brand losses to a rival brand, the greater the price increase will be if these brands merge.

8. While estimating a demand system for the main brands in a market can provide direct evidence on the unilateral effects of a merger, applying it in practice raises a number of complex methodological issues. In particular, assumptions need to be made about the structure of consumer demand to ensure the demand model is consistent with standard consumer theory and deal with the problem of dimensionality.[6] The analysis is highly data intensive and while many mergers require an assessment of competition at a wholesale level the necessary data are often only available at the retail level. And, there are various econometric issues that need to be considered. The number of methodological issues that are encountered in demand estimation means that there is invariably considerable scope for assessing the robustness and reliability of the analysis.

A. Models of consumer demand

9. Broadly speaking two types of demand models have been used in European merger cases – the nested logit model and the Almost Ideal Demand System (AIDS) model.[7] [8] These models make different assumptions about consumer behaviour and hence deal with the issue of dimensionality in different ways. The nested logit model imposes strong restrictions on the cross-price elasticities between products so that only a small number of parameters need to be estimated.[9] Products

1 A demand equation or model explains demand for a brand or product in terms of its own-price, the prices of its main competing products, consumer income and any other factors (such as marketing/promotional activity) that materially affect its demand.

2 These estimated price increases are typically interpreted as being illustrative rather than actual forecasts of the price increases arising from the merger.

3 Using either of these techniques to estimate the price effects of a merger also requires data on gross margins.

4 Thus, if 20% of the consumers who stop purchasing product A when the price of A increases, switch to purchasing product B, the diversion ratio from A to B is 20%.

5 The diversion ratio from brand A to brand B is the ratio of the cross-price elasticity of B with respect to A to the own-price elasticity of A, multiplied by the ratio of sales of brand B to sales of brand A.

6 The problem of dimensionality is that the number of price elasticities which have to be estimated is the square of the number of brands included in a demand system, so as more brands are included in the demand system, the number of price elasticities that have to be estimated increases more rapidly and so it becomes more difficult to accurately estimate these price elasticities (especially the cross-price elasticities) using the available data.

7 The AIDS model was first applied to mergers by Hausman, Leonard & Zona (1984), "Competitive Analysis with differentiated Products", 34, *Annales d'Économie et de Statistique*, p. 159-80.

8 While other models of consumer demand are used in the academic economic literature, such as the random coefficients model which explains demand in terms of how consumers value the characteristics of products, these models have rarely been used in actual merger cases, although the UK Competition Commission did attempt to estimate a random coefficients model in its recent Supermarket inquiry.

9 The nested logit can also include the characteristics of products to help explain consumer demand, see Berry (1994), "Estimating Discrete-Choice Models of Product differentiation", 25, *Rand Journal of Economics*, p. 242-62.

are grouped together into categories (nests) on the basis of being particular close competitors. Within each category the cross-price elasticities between the price of one product and the demands of the other products in the nest are all restricted to be the same. This restriction is known as the Independence of Irrelevant Alternatives (IIA), and means that substitution between products is proportional to their relative market shares. As a result of the assumption of IIA, the nested logit model requires just a small number of parameters to be estimated even if disaggregated SKU level data are used, and hence these parameters are typically very precisely estimated.

10. A different approach is normally used when the AIDS model is estimated. To limit the number of brands that have to be included in the AIDS model and thereby ensure the parameters can be accurately estimated, it is assumed that consumers use a multi-level decision making process when they purchase a product. The consumer first decides to purchase a product from a broad product category (e.g. athletic footwear), then the consumer decides to purchase a specific type of product within the broad category (e.g. a running shoe), and finally the consumer decides to purchase a specific brand/product of that type (e.g. Nike Air Classic). At each level of this decision making process a demand equation is estimated, and no restrictions are placed on the estimated cross-price elasticities between the products (or on any other estimated parameter) in that demand equation. Since the data used to estimate demand models are frequently retail scanner data (often very disaggregated SKU level data), these data have to be aggregated to some extent to be used in an AIDS model. Typically these data are aggregated across retail outlets such as supermarkets within a geographic area, and across the various SKUs of the same brand (or brand variety). Aggregating these data also reduces the number of brands that need to be included in the AIDS demand model, although it may affect the results.[10]

11. Using either the nested logit or the AIDS model of demand involves making some assumptions about consumer behaviour and hence imposing some restrictions on consumers' patterns of substitution. Of the two models the nested logit model imposes more restrictions on the cross price elasticities than the AIDS model. While both the nested logit and AIDS models involve allocating products or brands to particular categories, the logit model imposes the additional restrictions that the cross-price elasticities are the same for each product: the only additional restrictions imposed by the AIDS model arise from aggregating the SKU data up to the level of the brand. Given the cross-price elasticities are a key part of the evidence that demand estimation provides on the possible unilateral effects of a merger, it is preferable to impose as few restrictions on these as possible and let them be freely determined by the data. However, one drawback of the lack of restrictions imposed by the AIDS model is that the estimated cross-price elasticities can be negative (if products compete with each other, then the cross-price elasticities between these products should be positive), and the cross-price elasticities may not be very precisely estimated.

10 It is possible to examine whether the manner in which these data are aggregated affects the results of the analysis by re-estimating the AIDS model using different aggregations of the SKU data.

B. Data requirements

12. Demand estimation is more data intensive than most other empirical analyses. Not only does it require price and volume data for the merging parties' overlapping products, but it also requires price and volume data for the main competing products, data on aggregate consumer expenditure or income and ideally data on any other factors such as marketing campaigns, etc, that might have had a material effect upon consumer demand for these products over the sample period. Given these high data requirements, especially the need for data on the prices and sales volumes of rival products, demand estimation can normally only be undertaken in sectors where price and volume data are collected by third parties. As a consequence most demand estimation uses retail scanner data collected by marketing firms such as AC Nielsen and IRI. This reliance on scanner data means that the usage of demand estimation is largely restricted to mergers involving suppliers of consumer products sold in retail outlets. The usage of retail scanner data also means demand analysis gives estimates of the elasticities of these products at the retail level, but most mergers involve the upstream suppliers of these products. Although the demands faced by these upstream suppliers are derived from demand at the retail level, the retail and upstream elasticities for a product are the same only if certain conditions hold. Moreover, if much the variation in prices reflects market/promotional activities such as BOGOFs (buy-one-and-get-one-free offers), then this might lead the own-price elasticities to be over-estimated if consumers take advantage of these promotional offers to stockpile the product, although any effect this has on the estimated cross-price elasticities is likely to be considerable smaller.

C. Econometric considerations

13. Any analysis that uses econometric techniques has to address the issue of how robust and statistically reliable are the results. The robustness of the analysis can be examined by making different assumptions, using different aggregations of data, etc, and seeing whether these changes makes a material difference to the results. There are also a number of standard diagnostic tests that are used to examine whether the results of the econometric analysis satisfy various statistical criteria, such as the absence of serial correlation and heteroskedasticity, etc. In the case of demand estimation a standard econometric concern is whether prices are endogenous, as sales and prices are both determined by demand and supply. If prices are endogenous, then failing to take account of this may lead to biases in the results. One solution to this is to use data on variables such as variable costs to identify when changes in prices are due to changes in supply. This is known as instrumental variable estimation. While in theory the use of instrument variables deals with the problem of endogeneity, in practice it is difficult to identify such variables and get accurate data on them; for example, scanner data does not contain data on costs. The seriousness of this problem is also open to debate, as at least in the short-run, variations in the demand for many grocery products do not appear to affect their prices, suggesting that retailers' supply curves are flat.

D. *Friesland Foods/Campina*

14. Despite the ability of demand estimation to provide direct evidence on the possible unilateral effects of mergers, this econometric technique has been used in only a small number of cases in Europe. This limited use of demand estimation in European merger cases partly reflects the data requirements of this analysis, especially the need for data on the prices of competing products/brands which largely restricts its usage to mergers involving products sold via retail outlets. Demand analysis is also time consuming, so it can be difficult to do within the administrative timetable of a merger, and as with any empirical analyses there is no guarantee the analysis will produce informative results.

15. In the small number of cases where demand estimation has been used, concerns have almost always been raised about the robustness and reliability of the results. The most recent example of this was in the *Friesland Foods/Campina* case: see box for a summary of the case.[11] This case involved the merger of the two largest dairy co-operatives in the Netherlands, and the Commission was concerned about overlaps between the merging parties' brands in a number of dairy product categories. To provide evidence on the possible unilateral effects of the merger, in particular the extent to which the parties' branded products competed with private label products, as well on market definition, the Commission estimated a number of demand models using retail level data from IRI. Specifically, the Commission assumed consumers used a multi-level decision process, and estimated a series of AIDS models for six dairy product categories – fresh milk, buttermilk, natural yoghurt, custard ("vla"), fresh flavoured milk drinks and long-life flavoured milk drinks. In the Statement of Objections the Commission concluded that the results showed that in most of these dairy product categories the parties' brands were each others' closest competitors, and hence whether there would be material unilateral effects.

16. The parties' economists raised various concerns regarding the Commission's demand estimation. Apparently many of these concerns were primarily related to the Commission's use of the results for market definition, and to an extent the Commission accepted these concerns and did not rely on the results of the demand estimation for market definition purposes in the Decision. In terms of unilateral effects, the parties' economists questioned the robustness of the results. They found that including a non-competing product in the AIDS model for one dairy product segment produced results that showed it was a close competitor. They also highlighted that the problem of stock piling might bias the Commission's results and found the results of some of the Commission's AIDS models failed some standard statistical diagnostic tests. While the Commission accepted some of these points to a degree, it also questioned the significance of several of these points; for example, the Commission questioned the importance of stock piling for fresh dairy products which have a limited shelf life and are not subject to many promotions. More importantly the Commission undertook some additional demand estimation, partly in response to some of the points raised by the parties' economists, and found that the results of this additional demand estimation showed that the competitive interaction between the parties' brands was similar to that of private label brands. As a consequence the Commission did not rely upon the results of its demand estimation in the Decision.

> ***Friesland Foods/Campina – Case No Comp/M.5046***
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> This case, involving the merger of the two largest dairy cooperatives in the Netherlands, was notified to the Commission in June 2008. In July 2008 the Commission launched an in-depth investigation, and after the merging parties offered remedies to alleviate the Commission's competition concerns in a number of markets, the merger was cleared in December 2008.

Friesland Foods and Campina were both active at various levels of the dairy product supply chain, from the procurement and processing of raw milk, through to the production of a wide range of dairy products. Thus, the proposed merger raised concerns about possible vertical effects, as well as concerns about possible unilateral effects in the supply of the following dairy products; raw milk, fresh basic dairy products, long life dairy products, cheese, butter, value-added yogurt, flavoured dairy drinks, fresh dairy drinks cream, liquid coffee whiteners, sprayed dried emulsions and lactose.

Within these overlap product categories, the Commission not only considered the geographic dimension of the market, but also investigated in detail the dimensions of the product market. In particular, the Commission investigated whether sales of particular dairy products to different channels, such as grocery retailers, specialist retailers and out-of-home outlets, etc, were all in same market, as well as the extent to which private label and branded sales of particular dairy products were in the same market. In the case of the latter, one additional complication was that in many of these dairy product categories not only did the parties have leading brands, but they were also leading suppliers of private label products to retailers.

In its Decision the Commission relied upon a range of qualitative evidence and descriptive analyses, such as market shares, price differentials and trends, etc, to conclude that the proposed merger would lead to reduction in competition in the markets for the procurement of raw milk, fresh dairy products, long-life dairy products and cheese. To address these concerns the merging parties undertook to divest various businesses and brands in these markets, and to create an independent supplier of raw milk.

17. While there clearly needs to be a focus on the robustness and reliability of the results of demand estimation, it also needs to be recognised that demand estimation (like other econometric analyses) differs from most other types of analysis and evidence that are used in merger assessment, in that it is possible to assess the robustness and statistical reliability of the results in an objective manner: with most other types of empirical analysis and evidence it is not possible to do this in an objective way. Moreover it is almost always

11 Case No Comp/M.5046, Friesland *Foods/Campina.*

possible to find some limitation with any econometric analysis. Therefore even if the results of a demand estimation suffer from some limitations, these results can still be informative about the possible unilateral effects of the merger and the limitations should affect how much weight is placed on the demand estimation.

18. This appears to have been the approach the Office of Fair Trading (OFT) took in the recent InBev/Anheuser Busch merger, where there was a concern regarding the effect of the merger on competition between the parties' premium lager brands.[12] The merging parties' economists submitted an econometric analysis of the demand for lager in the UK to support the parties' argument that their lager brands were not particularly close competitors and were subject to material competition from third party brands, including standard lager brands. The OFT raised various issues regarding the estimated own- and cross-price elasticities with the parties, in particular it appears that not all of these estimated elasticities were statistically significant. However, despite these limitations the OFT recognised and accepted that the results of this demand estimation provided evidence showing that no InBev larger brand was the closest competitor of the Budweiser brand, and there was competition between premium lager brands and standard lager brands.

II. Residual demand estimation

19. An alternative way of using demand estimation to provide evidence on the unilateral effects of a merger in a differentiated product market is to estimate the residual demand curves of the merging parties' overlap products. A residual demand curve shows how demand for a particular product changes when its own-price changes and the prices of rival products also change in response to this change in the product's own-price. This is in contrast to a standard (or Marshallian) demand curve which shows how the demand for a product changes when its own-price changes, but the prices of rival products are held constant. Since a product's residual demand curve incorporates the price responses of competing products which will increase (decrease) their prices in response to an increase (decrease) in the own-price of the product, the residual demand curve of a product is less elastic that its Marshallian demand curve.

20. Residual demand analysis can be used to examine the potential unilateral effects of a merger by examining how the residual demands of the parties' overlap products are affected by the prices of the other merging party's products. This involves estimating both residual demands and the partial residual demands for all of the merging parties' overlapping products. The partial residual demand of a product is the same as its residual demand, except that it holds the price of the overlapping product of the other merging firm constant; e.g. the partial residual demand for merging product A is the same as the residual demand for product A, except that the price of merging product B is held constant, and this is done by including the price of product B in the residual demand for product A. Thus, the partial residual demand curve shows how demand for the product changes when it's own price changes, the price of the other merging firm's product remains constant, but prices of all rival third party products change in response to the change in the own-price.[13]

21. Comparing the estimated own-price elasticities of the residual demand and partial residual demand for a product provides evidence on the possible unilateral effects of the merger between products A and B. If the own-price elasticity of the partial residual demand for product A is considerably more elastic than the elasticity of its residual demand curve, then this is evidence that product B is a major competitive constraint on product A. This is because following an increase in the price of product A, a large volume of its sales would be lost to product B if its price remained constant. Conversely, if there is little difference between these two elasticities, then this means product B is not a major competitive constraint on product A, since following an increase in the price of product A few of its sales would be lost to product B, even if the price of the latter remained constant.

A. Modeling residual demand

22. Estimating a residual demand system involves, at least in principle, dealing with many of the same issues concerning how to model demand, data and econometric technique that are encountered when estimating a standard demand curve. In terms of the model of demand, the standard approach is to use a log-linear model, and the main issue is how to take account of the price responses of the competing products: i.e. how to capture in the residual demand model for a product, how and to what extent the prices of competing products respond to changes in the product's own-price. The price response of competing products will depend upon the nature of competition between the products as well as the variable cost functions of these products. In practice the standard approach is to include the main variable costs of all the competing products in the residual demand function, so the estimated coefficients on these variables capture the nature of competition. Since this means including a set of variable costs for each competing product, it is often assumed the competing products of the non-merging firms all have the same or similar marginal costs, so just one set of marginal cost variables is included in the residual demand model for these variables.

B. Data requirements

23. In terms of the data required to estimate a residual demand function, as well as data for the prices and sales volumes of the merging parties' overlap products, data are also needed for the main marginal/variable costs of each of the rival products, as well as for the parties' overlap products. As noted above it is normally assumed that these costs are the same for the rival products of the non-merging firms, so just one set of

12 Office of Fair Trading, "Anticipated acquisition by InBev NV/SA of Anheuser-Busch Companies, Inc", ME/3826/08.

13 For a general discussion of applying residual demand analysis to mergers see, Baker & Bresnahan, (1985), "The Gains from Merger or Collusion in Differentiated Industries", 33, Journal of Industrial Economics, p. 427-44.

marginal/variable cost data is need for these variables. Thus, one attraction of residual demand estimation compared with standard demand estimation is that it potentially requires less data, although this is just a result of the assumption that the variable costs for the non-merging parties' products are essentially all the same.[14]

C. Identifying a residual demand curve

24. Residual demand estimation raises similar econometric issues to those that are encountered in standard demand estimation. In the case of residual demand estimation, a key issue is whether the data contain sufficient instances when the merging parties were separately subject to firm specific shocks that give each of them an individual incentive to raise the price of their product, but which did not give any rival firms an incentive to raise the prices of their products. For example, this would occur if one of the merging parties had been subject to a cost shock which did not affected competing firms. These instances are needed in the data as they represent movements along the firm's residual demand curve, and hence enable the own-price elasticity of the residual demand curve to be estimated. If there are very few or none of these instances in the data (for example, because the cost shocks are common to all firms), then the data does not contain movements along the residual demand curve of the firm, so it is not possible to estimate the own-price elasticity of the firm's residual demand with any precision.

D. *INEOS/Kerling*

25. Residual demand estimation has been used in only a small number of merger cases in Europe. The most recent case where it has been used was the *INEOS/Kerling* case, which involved an overlap in the production of S-PVC in the UK: see box for a summary of the case.[15] Following the merger, the merged firm would have the only production facilities in the UK and account for about 65% of UK sales of S-PVC, with imports accounting the remaining 35% of sales. The key competition issue in this case was whether the geographic market was wider than the UK, or whether main source of competition in the UK were INEOS and Kerling. To address this issue the EU Commission used residual demand analysis, and attempted to estimate residual demands and partial residual demands for both INEOS and Kerling using data on the parties' prices and sales volumes, and data on industry variable cost from public sources and third-party S-PVC producers.[16]

26. The Commission was, however, unable to get robust and meaningful results from its residual demand analysis, and in its Decision the Commission relied upon other analyses and evidence to conclude that the market was wider than the UK and the merger would not have anti-competitive effects. The key difficulty was that in order to estimate INEOS' and Kerling's residual and partial residual demands, INEOS and Kerling needed to have been subject to firm specific shocks (such as firm specific cost shocks) which gave then an individual incentive to raise their prices, but which did not give rival firms an incentive to raise their prices. The main shocks that hit INEOS and Kerling over this period were increases in the cost of ethylene, the main input for S-PVC. However, the cost of ethylene is essentially common to all S-PVC producers in North-West Europe, so these cost shocks were to a large extent common to all producers and meant they all had an incentive to increase their prices of S-PVC. Thus the difficulty the Commission faced was that the dataset did not contain the type of variation needed to estimate a residual demand system.

INEOS/Kerling – Case No COMP/M.4734

This case involved the merger of the only two producers of suspension polyvinyl-chloride (S-PVC) in the UK; S-PVC is an input in the production of a wide range of plastic products, including window frames, plastic pipes and mouldings. The merger was notified to the Commission in July 2007, and in September 2007 the Commission decided to undertake an in-depth investigation of the merger. In light of the evidence obtained during this investigation the Commission unconditionally cleared the merger in January 2008.

While INEOS and Kerling were the only UK producers of S-PVC (with shares of UK sales of 25% and 40%, respectively), imports accounted for about 35% of UK sales and there are a number of large rival producers located in North-West Europe. The merged entity's share of sales in any meaningful geographic market wider than the UK, such as North-West Europe, would have been about 30%. Thus, the key issue in this case was whether the relevant geographic market for S-PVC sales was the UK, or was the UK part of a wider market.

During its in-depth investigation the Commission not only attempted to analyse the parties' residual demands, but also examined the response of importers and Kerling to an unexpected shut-down at INEOS' UK production facility. The Commission found that importers and Kerling were able to increase supplies in response to this and there was no evidence that prices increased as a result of the shut-down. The parties' also submitted further evidence showing most customers multi-sourced, many used imported supplies and had switched between domestic and imported S-PVC, and there had been a stable relationship between prices of S-PVC in the UK and Continental Europe, despite a sharp depreciation in the sterling-Euro exchange rate. Based on all this evidence, and evidence that transport costs were low and EU-SPVC producers had spare capacity, the Commission concluded that the relevant geographic market was at least as wide as North-West Europe and hence that the merger would not lead to any reduction in competition.

14 If there are material differences in the marginal costs of the competing products of the non-merging firms, then making this assumption may result in omitted variable bias.

15 Case No COMP/M.4734, *INEOS/Kerling*.

16 The Commission intended to use the results of the residual demand analysis to assess whether the geographic market was wider than the UK, even the results would have shown whether the merged firm would have been able to raise prices significantly in the UK even after rivals had responded to any increase.

III. Reduced form price analysis

27. The other main way econometric analysis is used in merger cases is by estimating some type of reduced form price analysis or reduced form margin analysis. Unlike structural analyses, reduced form price analysis is not an attempt to estimate the parameters of a formal economic model: demand estimation is a structural analysis as it involves estimating the parameters (the own- and cross-price elasticities) of a demand model. Instead reduced form price analysis involves examining whether there are any systematic relationships between prices/margins and the main determinants of these prices/margins; i.e. factors such as costs, conditions of competition, etc. Thus, reduced-form analyses can be viewed as an attempt to provide estimates of the overall effect of these variables, including conditions of competition, on prices or margins.

28. While reduced form price analysis does not involve using a particular economic model, it still requires a careful consideration of how prices are determined and firms compete with each other. This not only helps to ensure that the key non-competition variables are included in the analysis and competition conditions are measured in an informative manner, but it also helps to ensure that the analysis is structured in such a way so that it addresses the key unilateral effects in the merger. For example, if competition takes the form of suppliers offering discounts off list prices for large contracts, then reduced form price analysis could be used to see if the discounts offered by the merging parties are systematically lower when the parties both compete for a contract compared with when just one of them competes for a contract, after allowing for the presence of other competitors and non-competition reasons for why discounts might vary across contracts and customers.[17] Alternatively, if retailers set prices locally, then reduced form price analysis can be used to see if prices are systematically lower in localities where the merging parties directly compete with each other, compared with localities where they do not directly compete.

29. In merger cases, reduced form price regressions are used to examine whether variations in competition conditions, such as market concentration, the identity of rival competitors, etc, are systematically associated with the observed variation in prices or margins across competitive situations: competitive situations could be geographic localities/markets or individual customers if prices are negotiated with individual customers. The analysis can be done in various ways. The conventional approach is to examine the relationship between prices (or margins) and market structure across a series of competitive situations, while controlling for non-competition related reasons why prices might vary across these competitive situations.[18] Since the merger will lead to an increase in market concentration, if the results of the reduced form price analysis show there is a positive relationship between measures of market concentration such as the HHI, and prices, then this suggests that the merger will lead to an increase in prices. Conversely, if there is no evidence of a positive relationship between market structure and margins, then this suggests that a change in market concentration will not lead to an increase in prices.

30. An extension of the above approach which is often used, is to see whether the variation in prices or margins of a product across a series of markets or competitive situations is systematically associated with the presence or strength of a particular competing product in that competitive situation. In a merger case the key unilateral concern is whether the merging parties' products are particularly close competitors. If the results of the reduced form analysis show that the prices of the merging parties' products tend to be lower in competitive situations where the other merging party's product is present or has a stronger competitive position, then is consistent with these products being particularly close competitors and hence suggests that the merger will lead to increased prices. Conversely if there is no evidence in the results that lower prices are systematically associated with the presence or strength of the other merging party's product, but are systematically associated with the presence of other competing products, then this suggests that these other products are particularly close competitors.

A. Cross-sectional and panel data analyses

31. The econometric technique normally used to estimate reduced form price regressions, is cross-sectional estimation. This involves comparing prices in different competitive situations (such as different markets) at a given point in time, and testing whether prices are on average lower when the two products directly compete against each other, compared with when they do not directly compete. For this cross-sectional approach to generate robust and reliable results, the reduced form price regression needs to control for all the non-competition reasons why prices might vary across these markets, otherwise the analysis will suffer from omitted variable bias. This is a particular problem if the omitted non-competition variable is thought to be very closely associated with the presence or strength of other merging firm's product, as the estimated effect of the latter on prices will also capture the effect of the omitted variable on prices. Similarly, if one of the included non-competition determinants of prices is very closely associated with the presence or strength of the other merging party's product, then cross-sectional analysis will not be able to estimate the separate effects these factors have on prices, since there is little separate variation in these factors.

32. If there has been significant entry/exit or changes in the strength of the other merging party's products over time, then it is possible to use an alternative econometric technique, panel data estimation, to estimate the reduced form price regression. Panel data estimation involves comparing prices over time as well as across competitive situations to see how on average entry/exit or changes in the competitive strength of a rival product has affected prices. The advantage of panel data estimation over cross-sectional estimation is that with panel

17 This type of reduced form price analysis is often described as a bidding analysis.

18 Reduced form price analysis is essentially a version of the price/margin-concentration analysis found in the academic economic literature, although it is not normally interpreted in a structural manner.

data estimation it is possible to control for any factor that has a constant effect upon prices in any of competitive situations, even if no data are available on this factor.[19] However, for panel data estimation to product reliable results there does need to have been sufficient entry/exit or changes in the competitive strength of rival products in these competitive situations over the period of the data.

B. Data requirements

33. The data requirements of reduced form price analysis are normally not as high as those for demand estimation; especially as data on the prices and sales of rival products are not needed. However, this type of analysis still requires a considerable amount of data. It requires data on prices for the merging parties (or market prices), the main non-competition determinants of prices and variables measuring the competitive structure for a series of competitive situations, and also over time if the panel data estimation approach is used. Clearly in order to apply this type of analysis there must be some variation in prices and in competitive conditions across competitive situations such as local markets; these variables also need to vary over time if panel data estimation is used. Moreover, when it is unclear what is the "correct" definition of the competitive situation, data on competitive conditions are needed for different possible definitions of the competitive situation. For example, if it is not obvious what is the correct definition of the local market, then measures of competitive conditions for different definitions of the local market are needed.

C. *Ryanair/Aer Lingus*

34. Reduced form price analysis has been used in a number of high profile merger cases to provide evidence on unilateral effects. The most high profile instance of this analysis being used is probably in the proposed merger of *Ryanair/Aer Lingus* that was prohibited by the EU Commission in 2007: see box for a summary of the case.[20] This case provides a good example of how reduced form price analysis can be used to provide evidence on unilateral effects. The proposed merger would have bought together two primarily no-frills airlines who direct competed with each other, often just with each other, on a large number of routes out of Dublin airport. Thus the main concern of the Commission was whether the proposed merger would have resulted in material unilateral effects on these routes.

35. Since both fares and competitive conditions vary across routes, reduced form price analysis could be used to assess the possible unilateral effects of merger. Specifically, this analysis can be used to assess whether Aer Lingus' fares are, on average, lower when it faces competition from Ryanair compared with when Aer Lingus does not face such competition, after allowing for other factors that affect fares across routes. Similarly, it can also be used to assess whether Ryanair's fares are on average lower when it faces competition from Aer Lingus compared with when it does not face such competition.

36. Since Ryanair had entered on a material number of the overlap routes in the previous five years CRA used a panel data approach to estimate what effect the entry of Ryanair had on Aer Lingus' fares and its load factors.[21] To do this CRA regressed Aer Lingus' average monthly fares for a large sample of routes on a number of control variables and three different measures of competition – indicators for which airlines were present, shares of seat capacity on the route and each airlines' monthly capacity on that route. As a further robustness check CRA undertook the analysis on the basis of airport pairs as well as city pairs, since while Aer Lingus tends to fly to primary airports, Ryanair often flies to secondary airports. The results of this analysis showed that where Ryanair had entered on an Aer Lingus route, Aer Lingus' fares were systematically reduced and this effect was statistically significant. It also showed that the entry of Ryanair systematically reduced Aer Lingus' load factors.

37. The Commission used a very similar panel data approach using data from both parties. It also found that the entry of Ryanair had a significant negative effect upon Aer Lingus' fares. The Commission found no robust evidence that the entry of Aer Lingus had a significant negative effect upon Ryanair's fares, but this was not too surprising given Aer Lingus had entered on just a very small number of the overlap routes: i.e. there was insufficient entry/exit by Aer Lingus for the panel data to give robust results for Ryanair. The Commission also undertook a cross-sectional analysis, but did not rely on these results as it had serious reservations about the reliability of this cross-sectional approach.[22] Overall the Commission concluded that the reduced form price analysis provided robust evidence that Ryanair was a material constraint on Aer Lingus, and the results of this analysis were an important reason why the Commission prohibited the transaction.

Ryanair/Aer Lingus - Case No COMP/M.4439

This case was notified to the Commission in October 2006, and in November 2006 the Commission launched an in-depth investigation. As a consequence of this investigation, the Commission decided in June 2007 to prohibit the merger; the first time an airline merger was blocked by the Commission. Ryanair has launched an appeal against the Commission's prohibition at the Court of First Instance. Ryanair also renewed its attempt to merger with Aer Lingus in January 2009, but abandoned this merger during the Commission's initial review.

The proposed merger would have brought together the two leading Irish airlines. Ryanair is the leading low-cost, low-fare airline in Europe and has its second largest European base in Dublin. Aer Lingus operated more 70 short-haul European

19 This is done by including dummy variables (know as fixed effects) for each competitive situation in the reduced form price regression.

20 Case No COMP/M.4439, Ryanair/*Aer Lingus.*

21 CRA acted for Aer Lingus in this case.

22 Ryanair's economists also used a cross-sectional approach.

flights out of Dublin and since 2001 has adopted a low-cost, low fare model for its European routes. Thus, unlike previous airline mergers, this case involved two primarily no-frills airlines who both had major bases at Dublin Airport, and the Commission's main concern was whether the merger would lead to material unilateral effects.

The Commission's investigation found that the two airlines overlapped on 35 routes out of Ireland, and they had an average share greater than 85% on these 35 routes. Moreover, on 22 of these overlap routes, the parties were the only competitors and so would have had a monopoly position post-merger. While on 20 of the 35 overlap routes, Ryanair and Aer Lingus served different destination airports, a consumer survey done for the Commission at Dublin airport showed that on most routes consumers viewed the different destination airports as substitutes. The investigation also found further evidence that both airlines compete with each other (contrary to Ryanair's claims), as the commission found both airlines monitor each others' prices and use yield management techniques that change fares in response to variations in their demands, including those caused by changes in competing airlines' capacities and pricing.

Based on the above evidence and the results of the econometric analysis, the Commission concluded that the proposed merger would have created sizable unilateral effects. Although Ryanair offered to divest slots at Dublin Airport, the results of the market testing meant the Commission could not conclude with sufficient certainty that new entry would occur on the affected routes, and hence the Commission decided to prohibit the merger.

Conclusion

38. Econometric analyses are increasingly being used to provide direct evidence on the possible unilateral effects of mergers in Europe. Demand estimation has been used to estimate own-price and cross-price elasticities, which can then be used to assess the possible unilateral effects of a merger. Reduced form price analysis has been used to provide evidence on whether there is any systematic relationship between prices and conditions of competition, and hence whether the merger, by changing these conditions of competition, will lead to an increase in prices. A key issue is how robust and reliable are the results of these econometric analyses, and this has been a major issue in all the recent European merger cases where econometric analyses have been used. The best-practice guidelines on the submission of econometric analysis just published by the UK Competition Commission, also stress the importance of the robustness and reliability of econometric analyses.

39. Obviously the robustness and statistical reliability of econometric analyses is very important, since like other analyses and evidence, they will only improve the quality of merger assessment if their results are robust and reliable. However, it also needs to be borne in mind that unlike most of the other types of analyses and evidence used in merger assessment, it is possible to assess the robustness and reliability of econometric analysis in an objective manner. Moreover, the number and nature of the methodological issues involved in econometric analysis means it is almost always possible to find some limitation with the analysis. Given this, any limitations of econometric analyses should be used to determine how much weight should be placed on the results on the analysis in the merger assessment rather, as can be the case, be used to dismiss the evidence entirely. ■

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