The Use of Quantitative Economic Techniques in EU Merger Control

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Abstract

In some recent merger cases the European Commission has relied on quantitative economic techniques in the competitive assessment of horizontal mergers. These techniques have ranged from the use of merger simulation models (for both differentiated and homogenous goods), to the deployment of direct estimation methods to study the effects of relevant events in the past. This article describes the appropriate use of these quantitative techniques, and it explains the rationale for the reliance on these methods. It also explains why the evidence from economic modelling is complementary to more traditional qualitative evidence on the expected impact of horizontal mergers.

The European Commission's Directorate General for Competition often relies on quantitative economic analysis in its review of complex mergers. This analysis is typically developed during in-depth investigations (so-called Phase II reviews). There is a range of economic techniques that can be applied to the competitive assessment of mergers. The choice of the relevant economic methodology depends on the features of the market at hand, on the key questions raised by the merger, and on the availability of suitable data.

Quantitative economic methods applied by the Commission to the assessment of mergers are often one of two broad types: merger simulation techniques and direct estimation methods. Merger simulations seek to approximate the effects of a merger on the main competitive variable of interest (typically price) through an internally coherent assumed model of competition in the industry which takes account of important observed or measured market features (such as substitution patterns and margins).

Direct estimation methods, on the other hand, seek to study the impact of past events in the markets at hand, using historical data. For example, direct estimation techniques can be used to measure the impact of past entry events (typically involving one or both of the merging parties) or past mergers. The insights from the direct estimation of past competitive events' impact can then be used to make inferences on the possible effects of the merger at hand.

In this article we review the Commission's recent application of these two families of quantitative economic methods in merger control.[1]

Merger simulations

The Commission has relied on merger simulation techniques in a number of recent cases. There have been two main applications of these techniques: mergers in mobile telephony markets and two mergers in industrial commodities (specifically, in stainless steel and in the

chemicals sector). In the first application (mobile telephony markets), the Commission applied simulation techniques that are suitable for pricing of differentiated products (as described in Section 6.1 of the U.S. Horizontal Merger Guidelines).[2] In the second application, the Commission deployed a model that is more suitable to the analysis of competition in homogeneous product markets in the presence of fixed industry capacity (which is more closely related to issues described in Section 6.3 of the U.S. Merger Guidelines).

The main objective of merger simulations in these cases has been to obtain an estimate of the order of magnitude of the likely effect of the relevant mergers on prices, based on an internally coherent model of competition that is capable of reflecting several of the key competitive variables of each market. The use of these techniques allowed for extensive sensitivity analysis of the simulation based on an alternative set of input parameters and for direct balancing of the efficiency claims made by the merging parties.

While useful for a quantitative assessment of certain key features of the merger within a tractable model of the industry, simulation models necessarily abstract from some potentially relevant features. In all the cases where merger simulation techniques were employed, the results were hence integrated with the qualitative evidence on the likely effects of the merger (e.g., from the review of internal documents and from views of market participants), and read in conjunction with this evidence. The results of the merger simulations were therefore only one of the elements used by the Commission to come to its overall assessment of the relevant mergers.[3]

Pricing of differentiated products in mobile telephony markets

The Commission has reviewed a series of horizontal mergers in mobile telephony markets since 2012, including mergers in Austria (2012), Ireland (2014), Germany (2014), Denmark

(case withdrawn in September 2015), the UK (2016), and Italy (2016).[4] A merger raising similar issues in the Spanish telecommunication market was approved in 2015.[5] Each of these mergers implied a reduction in the number of mobile network operators, or infrastructure competitors, from four to three.

In each of these cases (with the exception of the first case in Austria in 2012[6]) the Commission used a merger simulation that estimated the likely impact of the merger on retail prices for each operator and for the market as a whole, on the basis of a number of inputs (including most notably profit margins and diversion ratios across competitors). These merger simulations can be seen as an application of the price pressure techniques described in Section 6.1 of the U.S. Merger Guidelines.[7]

The basic idea behind price pressure techniques is to approximate the unilateral effects of a horizontal merger. The incentive of the merged entity to increase prices flows from the fact that prior to the merger neither of the merging parties internalizes the fact that setting a higher price diverts sales and profits to the other party. This diversion is internalized by the merger, thus leading to an increased potential for higher prices. The incentive to raise price, and hence the predicted price effects by the parties, are greater the greater the diversion of sales between the parties (in reaction to a price increase) and the higher the profit margin on the additional units sold by each of the merging parties.[8]

Pricing pressure techniques are typically based on the assumption of Bertrand-Nash competition between firms offering differentiated products (i.e., the standard competition model for pricing of differentiated products). They can be applied just to the prices of the merging parties, but can also be extended to account for the additional effect on the pricing of non-merging parties (feedback or equilibrium effects), in order to approximate the overall impact of the merger on market prices.[9]

In the mobile telephony cases, the Commission used a merger simulation model based on this standard competition model. The number of competitors to the merging parties is fixed by assumption in this model, and therefore the simulation is not suited to analyze the issue of possible entry by other firms following the merger. When barriers to entry are high (as the Commission found in the mobile telephony market) this assumption is likely to be reasonable.

The model was populated with diversion ratios between each operator using number portability data available in each market. This data records the origin and destination operators for consumers who port their numbers when switching between operators (which does not necessarily capture price-based switching only). In some of the more recent cases, the Commission supplemented the portability data with the results of a consumer survey designed to measure diversion between the merging parties on the basis of hypothetical changes in price, to better approximate price-based substitution. Diversion between operators was computed at both the mobile network level and at the retail level (accounting for the presence of "virtual" network operators who access the infrastructure of mobile network operators). Diversion ratios at the retail level are lower by design than diversion ratios at the network level (since they include more competitors), and therefore predict lower likely price effects of the merger.[10]

The profit margins used in the simulation were derived from accounting data submitted by the operators (measuring both direct and contribution margins), supplemented by additional information on additional incremental costs (e.g., incremental network costs) provided by the merging parties and assessed by the Commission.

To estimate the likely impact of the merger on final prices, the model assumed that the demand faced by each operator is linear in price (that is, the change in quantity demanded in response to a change in price has a constant ratio). This assumption implies a lower degree of

pass-on of any given upwards pricing pressure to the final price, and hence leads to lower estimates of the final effect of a merger on prices than many other standard assumptions on demand (e.g., constant elasticity demand or logit demand).[11] An assumption on aggregate demand elasticity (i.e., the reduction in total demand in response to higher prices) was also considered by the Commission in its merger simulations.[12]

To take a concrete example of this exercise, consider the merger between H3G and O2 in Ireland (cleared by the Commission subject to remedies in 2014). In its final decision[13] the Commission reported illustrative price rises (IPR) for the two merging parties (i.e., price increases by the parties assuming other firms hold their prices constant) in the range of 4–9 percent for the main segment of overlap (the post-paid private segment), based on sensitivities on the level of profit margins (using both contribution and incremental margins), and on the diversion to an outside good (considering a case with 0 percent diversion and 20 percent diversion).

The Commission also reported the results of the merger simulations accounting for equilibrium reactions by rivals. Under this scenario, the increase in prices of the two merging parties was higher than under the IPR (given that rivals respond to the merger by also increasing prices, thus making a further price increase by the merging parties profitable). The market-wide effect of the merger, considering both the price increase of the merging parties and that of non-merging parties, was computed to be in the range of 4–9 percent in the post-paid private segment, and 3–7 percent in the overall private segment (including both pre-paid and post-paid contracts). The Commission considered these price effects to be significant and not outweighed by the efficiencies substantiated by the merging parties.

The reliance on merger simulation techniques can yield several benefits, as illustrated by the Commission's experience in the assessment of the recent series of mobile mergers.

First, it provides a quantitative estimate of the impact of the loss of competition due to the merger, thus helping to substantiate whether a transaction may be expected to lead to a significant lessening of competition. The estimation of the likely price effects can be subject to extensive robustness analysis by considering different input assumptions (e.g., on the level of diversion ratios, on the level of margins, and on the aggregate elasticity of demand). This increases the reliability of a conclusion on whether the merger is likely to result in a significant lessening of competition.

Second, the quantification of price effects from a merger simulation can be useful to complement qualitative evidence commode on the effect of consolidation in mobile telephony markets, including the documentary evidence found in some of these cases on the "market repair" benefits of consolidation (effectively a euphemism for higher prices and profits), on expectation of more "rational pricing," and/or on the additional revenue expected from the merger by removing a competitor.[14]

Third, the merger simulation allows for a quantification of likely consumer harm which can be offset against substantiated efficiency claims. Merger simulations can deal with variable cost efficiencies in a straightforward way, given that the framework applies the same assumption to the pass-on of upward pricing pressure from a merger and to the pass-on of downwards pricing pressure from a cost reduction. This allows for an internally coherent balancing exercise.[15]

Pricing pressure models can in principle also allow for efficiencies in the form of quality increase following a merger.[16] In most of the recent mobile telephony mergers, the parties claimed that the transactions would lead to higher network quality (e.g., in terms of network coverage and speed), and therefore be procompetitive. In practice, the Commission did not use the prediction from the merger simulation in the mobile telephony cases to balance

harm against the benefits from higher network quality, given that it concluded that the claims made by the parties were either not verifiable or not merger-specific (most notably because substantially the same benefits could be achieved by less restrictive alternatives, such as network sharing).[17]

Pricing of homogenous goods in commodity markets

The Commission has also used a merger simulation model in two recent cases involving industrial commodities (*Outokumpu/Inoxum*[18] and *Ineos/Solvay*[19]).[20] The Commission chose a Bertrand-Edgeworth (BE) framework in these cases, which analyses price competition between firms offering homogeneous products subject to fixed production capacities for each firm.

In both cases the respective industry was characterized by overcapacity stemming from investment decisions made in the past under different market conditions. The level of plant capacities did not seem to be a major decision variable by firms at the time of the investigations. Moreover, consumers in these industries choose among competing suppliers largely on the basis of price. The BE framework hence seemed appropriate to assess these cases and preferable over alternatives models for homogeneous product markets, which assume that firms compete in quantities (directly or through capacity adjustments). The assumption of price competition in homogeneous products was also in line with the merging parties' submissions on the nature of competition in these industries.

Absent any capacity constraints (and assuming that firms do not coordinate), price competition between two or more firms in a homogeneous product market is predicted to be very intense. By the standard Bertrand logic, firms find it profitable to undercut each other's prices and capture the entire market until prices are driven down to marginal costs. However, in the presence of fixed capacity constraints, a degree of market power may be restored (as

originally pointed out by Edgeworth). Firms whose competitors do not have enough capacity to supply the entire market cannot lose all customers to their competitors and hence have a "guaranteed" share of demand that they can exploit. This eliminates their incentives to price all the way down to marginal costs where profits would be zero. Instead, at some price level above marginal costs, these firms would stop undercutting their rivals as it is more profitable to set a high price, which allows them to extract positive profits from their 'guaranteed' share of demand. The BE framework formalizes this effect.

In this setting, a merger that results in a substantial consolidation of capacities can lead to an increase in the merged entity's market power. As the merged entity faces less capacity from competitors, it has a greater "guaranteed" share of demand which it can exploit compared to each of the merging firms pre-merger. This provides the merged entity with an incentive to stop undercutting earlier and may lead it to set overall higher prices.

The BE model needs to be populated with a number of inputs in order to generate a prediction on pre-merger and post-merger outcomes. These include the level of market demand at prevailing market prices, the level of capacity available to each competing firm and their variable costs, the price elasticity of aggregate demand, and the price responsiveness of sales by producers located outside the geographic area that is the focus of the analysis (e.g., imports into the EEA in the case of *Outokumpu/Inoxum*, and sales into a region defined by the Commission as "North-West Europe" in the case of *Ineos/Solvay*).

In *Outokumpu/Inoxum*, a merger between the two largest EEA producers of cold rolled stainless steel, the Commission used the BE model as a comprehensive and internally coherent framework to jointly test the main arguments made by the merging parties for why the transaction would not be expected to increase prices. The Commission took at face value the parties' arguments on the nature of competition, on the responsiveness of demand and

imports to prices in the EEA, and on variable cost efficiencies resulting from the transaction and combined them with estimates of firms' (spare) capacity levels and costs to populate a BE model. The Commission found that: (1) the parties' arguments overstated the degree of competition in the industry pre-merger to a limited extent (as pre-merger margins predicted by the model were somewhat lower than observed margins); and that (2) even accepting the parties' arguments, the significant capacity consolidation brought about by the merger would still lead to a reduction in competition (as the model predicted a price increase in the range of 5–10 percent). The parties' arguments were hence not sufficient to dispel concerns on unilateral price effects resulting from the transaction. The transaction was ultimately cleared subject to substantial divestments.

In *Ineos/Solvay*, a transaction creating a joint venture between the first and second largest producers of commodity suspension polyvinyl chloride (S-PVC) in Northwest Europe (NWE), the BE model was initially presented by the merging parties to demonstrate that the efficiencies associated with the transaction, combined with the divestment of some productive capacity, would be sufficient to prevent a price increase. The Commission reviewed and adapted the model submitted by the parties, showing that absent efficiencies and remedies, the merger would likely lead to a significant increase in market power. This remained the case even if one accepted the entirety of the variable cost efficiency claim made by the merging parties (with prices still predicted to rise in the model by 5–20 percent in this case, depending on the calibration assumptions). In its final decision, the Commission cleared the merger with more extensive remedies than those initially submitted by the merging parties, due to concerns about both the competitiveness of some of the assets initially put forward, and the initial scope of the remedy package.[21]

Direct estimation of the impact of past events

In some recent merger cases, the Commission has relied on quantitative techniques to estimate directly the impact of past events. In what follows, we will focus on two main applications of these techniques: the industrial chemicals merger *Ineos/Solvay*, and a merger in the coffee industry. In the first application (industrial chemicals), the Commission carried out an ex-post evaluation of recent past mergers in the same industry to gain insight into the likely effects of a proposed merger as well as on a geographic market delineation question (see also Section 2.1.1 of the U.S. Merger Guidelines). In the second application (coffee systems in the *DEMB/Mondelēz* merger case[22]), the Commission estimated the impact of past entry events by one merging firm's coffee systems into various geographic markets on the pricing of the other merging firm's coffee system. This analysis focused on the closeness of competition between the different systems. (This type of evidence is also mentioned in Section 2.1.2 of the U.S. Merger Guidelines).[23]

The common trait of these applications is that they use information on markets affected by past events, such as entry or previous mergers, and compare these markets to other markets that were not affected by the events. This is to shed light on the competitive interaction between the merging parties. The markets to be compared can be different product or geographic markets. In the two cases discussed below, the Commission used different geographic markets as comparators.

The impact of an entry, exit, or past merger event can be used as evidence of the closeness of competition between different products or firms. If, for example, a new competitor enters a geographic market and offers a close substitute for the incumbent's product, the price of the incumbent product is expected to decrease following the entry. Hence, the evolution of the incumbent product's price before and after the entry can be a

valuable source of information on the actual strength or closeness of competition between the incumbent's and the newly entered rival's products. The stronger the price decrease of the incumbent's product following the rival's entry, the stronger the likely competitive interaction.

While conceptually simple, the econometric measurement of such effects can be complex. Simple comparisons of the affected market's prices before and after an event might be misleading because the price changes can also be the result of other factors influencing market outcomes, such as changes in costs or demand conditions. For example, if prices have a decreasing tendency even before and independently of the event, one would falsely attribute the lower post-entry average price level as an effect of the entry—even if the entry did not actually impact prices.

The problem can be alleviated by a number of techniques that isolate the effect attributable to the event from the effect of other factors. One approach, which has been used in the recent cases discussed here, is based on comparing the evolution of prices in the affected market (the "treated" market) to the evolution of prices in other geographic markets for the same product—with otherwise similar demand and cost conditions—where no entry or other event occurred. These other markets are referred to as the "control" markets or control group.

The control group is assumed to represent how the treated market would have behaved had the entry (or exit or merger) event not happened. Importantly, the control markets form a valid basis of comparison if they have the same characteristics as the treated market but for the effect of the event studied. If the prices do not change significantly in the control markets when the event happens in the treated market, and the prices do change in the latter following the event, it is more likely that this price change is attributable to the event. Similarly (in the

case of an entry event), if prices have already been decreasing in both markets, entry might result in a more rapid decrease of prices in the treated market compared to the control markets. If, however, the control markets' prices decrease similarly during the same time periods, the effect is less likely to be an entry effect. This methodology of double comparison (comparing first within-market pre-event prices with post-event prices, and second comparing these price changes across the different markets) is also called the "difference-in-differences" methodology.[24] The difference-in-differences methodology can also be used to measure the (average) effect of several events that take place in different geographic markets (at the same time or at different times).[25]

In a merger context, it is important to emphasise the proper interpretation of the outcomes of such difference-in-differences analyses. Even though the price effect estimates can be thought of as a direct quantification of the impact of the past merger (or entry or exit) events, care has to be taken in interpreting them as estimates of the effect of *future* mergers.[26] In the cases discussed below, the impact estimates of past events were rather used as evidence helping to establish whether conditions conducive to anticompetitive effects of the proposed transactions prevailed prior to them. These conditions could include close competition between the merging parties, existing market power of one or both of the parties, or market delineation patterns indicating the lack of sufficient competitive constraints on the markets where the merging firms are active.

As in the case of simulation methods discussed in the previous section, the results of the direct estimation methods were used in conjunction with the available qualitative information on file (market interviews, internal documents, etc.) to form the assessment of the proposed transactions.

In *Ineos/Solvay* the Commission used, in addition to the Bertrand-Edgeworth simulation model (discussed in the first part of this article), a quantitative difference-in-differences analysis of past mergers in the industry. Prior to the transaction, the S-PVC industry had already seen two previous mergers, both involving Ineos. In particular, Ineos bought a competitor in 2008 with production assets in the UK and Scandinavia, and purchased another firm in 2011 with factories in the Benelux countries and France. As a result, by the time of the notified transaction Ineos had grown into the clear market leader.

Ineos' previous mergers made it possible to analyse the effect of consolidation on competition and prices in a direct effect estimation framework. The Commission collected detailed, transaction level datasets from both merging parties covering the 2007–2012 period on a monthly basis. The data included invoices, values and volumes of transactions, information on the location of customers and production plants, as well as technical characteristics of the products and their costs. The treated and control markets were defined geographically: the treated group was the set of transactions belonging to regions affected by the past mergers, while the transactions in non-affected regions formed the control group.

In particular, the difference-in-differences-based comparative analysis contributed to answering three key questions in the case. First, an issue to be investigated was whether Ineos already possessed market power prior to the proposed transaction, which would have made this merger more likely to be anticompetitive. Second, if the past mergers resulted in significant price increases, the analysis could provide evidence on the regional segmentation of the European market. In particular, the question was whether the NWE region was or was not sufficiently constrained by competition from the Rest of Europe (ROE). Third, an ex-post analysis of the previous mergers could indicate whether the assumptions that were made in

the respective clearance decisions might have to be revisited. These assumptions mainly involved the existence of sufficient rival spare capacity, customers' ability to switch supplier, and EEA and import competition as effective competitive constraints on the merging parties.

The Commission used two versions of the difference-indifferences analysis. The first version compared Ineos's prices in the NWE region to those in the ROE regions, and calculated how much the price difference between the two regions increased after the two previous mergers. Hence in this version, the previous mergers focused on the NWE region so customer transactions in this region formed the treated group, and those from the ROE regions were the control group. The second version compared Ineos's price premium relative to Solvay between NWE and ROE, and analyzed whether the regional difference in the price premium increased after the mergers. The second version of the methodology is likely to underestimate the effect of the past mergers, as Solvay might have reacted to these transactions by increasing its prices due to the reduced overall competition in the market. As such, finding a merger effect on the price premium would be considered strong evidence of merger-induced unilateral price effects.

The results indicated that past consolidation (in particular the previous Ineos/Tessenderlo merger) led to price increases, both in an absolute sense (first version), and on the Ineos price premium relative to Solvay's prices (second version). These results, combined with the evidence on volume changes in the treated market, led to the conclusion that Ineos already had a degree of market power prior to the proposed transaction; that the NWE region was a separate geographic market;[28] and, as a result, the assumptions that allowed the Commission to clear the previous mergers (spare capacity, customer switching, and strong EEA and import competitors) could not be relied upon in the assessment of the proposed transaction.

As already mentioned, the impact estimates of past merger events cannot be conclusively interpreted as estimates of the effect of future mergers. Accordingly, as described above, the evidence was rather used to establish existing market power and conditions conducive to anticompetitive effects of the proposed transaction. This finding and a large body of other qualitative and quantitative evidence (including extensive documentary evidence on the impact of past consolidation, data on the evolution of volumes after past consolidation, evidence on limited spare capacity by rivals, as well as the simulation modelling discussed in the first part of this article) jointly provided the basis for the conclusion that the proposed merger would lead to a significant impediment to effective competition.

Entry and exit in the coffee systems markets

In *DEMB/Mondelēz*, a joint venture case between two leading coffee manufacturers, one of the important issues was competition between coffee systems.[29] Traditionally, coffee was mostly prepared as "multi-serve" drinks (such as drip filter coffee using ground coffee powder) with several cups of coffee brewed simultaneously. More recently, single-serve systems, which generally brew only a single cup of coffee at a time, have also become popular. Such "coffee systems" are comprised of coffee machines and coffee consumables (e.g., capsules and filter pads) that can be used only with the specific machine. In Europe, several coffee systems belong to this segment, most prominently Nestlé's Nespresso, Nestlé's Dolce Gusto, DEMB's Senseo, and Mondelēz's Tassimo.[30]

Single-serve coffee systems are differentiated with respect to the type of coffee they make (from filter style coffee to espresso style); whether they are limited to black coffee or whether they produce milky or flavored variations; and whether the system is closed or open (i.e., whether or not consumables can also be bought from third-party providers). The

qualitative evidence (from internal documents and market participants) indicated that the Tassimo brand was primarily competing with Dolce Gusto, while Senseo (which is closer to filter coffee) was a more distant competitor to these two brands and Nespresso. The merging parties also argued that their two systems did not exercise a strong competitive constraint on each other. However, Nestlé, a complainant, argued that the Senseo and Tassimo brands were closer competitors to each other than Tassimo and Dolce Gusto.

To assess the issue, the Commission complemented its qualitative analysis by a quantitative study of the entry of Mondelēz's Tassimo into several countries. While the merging firms are directly active in the "aftermarket" or "secondary market" for consumables, they are only indirectly active in the "primary market" for machines, through long-term design and development co-operations to various extents with machine manufacturers.[31] Nevertheless, coffee manufacturers can and do influence machine prices indirectly through promotional activities and subsidies. Hence, the Commission investigated the merger's potential impact on the market for single-serve machines. The quantitative assessment focused on the sale of machines to shed light on the degree of competition between coffee systems. This assessment was complemented by a qualitative analysis of the links between the primary and after markets.[32]

The data collected covered 21 European countries for the period 2004 to 2014. During this period the Tassimo system was introduced in eight countries, Nestlé's Dolce Gusto was present in 20 countries, and DEMB's Senseo was present in ten. The Commission used two separate econometric models to assess the impact of Tassimo's entry on (1) Dolce Gusto and (2) Senseo machine prices, respectively. In the Dolce Gusto analysis the treated geographic markets were those countries where a Tassimo entry event happened in a given month, while

the control group included those countries where Dolce Gusto was present but there was no Senseo entry at the same time. A similar structure was used for the Senseo analysis.

These econometric models used the difference-in-differences methodology comparing the average percent price drop for Dolce Gusto (or Senseo, respectively) machines following the Tassimo entry with the evolution of the average Dolce Gusto (or Senseo, respectively) machine prices during the same period in the countries where no such entry happened.

The results showed that the entry of Tassimo was associated, on average, with a decrease in the prices of both Senseo machines and Dolce Gusto machines. These estimated price responses were statistically significant for Dolce Gusto machines but not for Senseo machines. Hence, these quantitative outcomes indicated that Tassimo represented some competitive constraint for both types of rival machines, but with the effect of Tassimo's entry on Dolce Gusto's prices being stronger than on Senseo's prices (both in terms of magnitude and statistical significance).[33] Hence, these findings were consistent with Tassimo being closer to Dolce Gusto than to Senseo, as indicated by the qualitative evidence. These results proved robust when subject to extensive robustness checks.[34]

As the merging firms are primarily active in the aftermarkets, the results of the quantitative analysis were not directly indicative of the likely effect of the merger on the single-serve machine market. Rather, they showed which particular single-serve systems compete more vigorously with each other. In this respect, the merging firms were not necessarily each other's closest competitors. The qualitative and descriptive evidence obtained by the Commission further documented that other factors, such as the incentive to increase the penetration of machines, especially in the case of more recent entrants, such as Tassimo, implied that the incentive to raise machine prices following the merger would likely be muted. This finding was further reinforced by the degree of contractual independence of

the machine manufacturers from the coffee firms and their incentive to increase machine penetration.

Overall, the Commission concluded that both the qualitative and quantitative evidence indicated that the merger would not lead to a significant loss of competition in the segment of single-serve coffee machines. The transaction was cleared without commitments related to machines.

Conclusion

In this article we have described the use of merger simulations and direct estimation techniques by the European Commission in recent merger cases. These quantitative techniques can be useful to assess certain key features of proposed mergers in an internally coherent quantitative approach.

For example, merger simulation techniques can provide quantitative indications on whether observed measures of substitutability between the products in the market are such that the elimination of competition through the merger is likely to lead to significant unilateral price effects; whether spare capacities by non-merging firms are likely to exert a sufficient competitive constraint on the merged entity; or whether claimed efficiencies are likely to offset an increase in market power resulting from a merger.

Direct estimation of the effects of past entry events or mergers can also be informative on competitive interactions or on whether past mergers have led to increased market power.

The Commission selects quantitative techniques which are suited to quantitative analysis of particular markets, both in terms of data availability and in terms of the applicability of the basic premises underlying the analysis (e.g., the presence of high barriers

to entry in the case of merger simulation techniques or the comparability of the treated and control markets in the case of the direct estimation techniques).

While such techniques may allow a quantitative assessment of certain key aspects of a proposed merger, they typically cannot take account of all important features of the industry and require reliable data to derive their predictions. The Commission therefore reads the results of such quantitative techniques in conjunction with a careful analysis of the available qualitative evidence.

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[1] For a comprehensive review of the Commission's use of economic evidence in merger analysis as of 2011, see the EU country chapter in OECD Policy Roundtables, *Economic Evidence in Merger Analysis*, DAF/COMP(2011), 23 July 2012, at 245, http://www.oecd.org/daf/competition/EconomicEvidenceInMergerAnalysis2011.pdf. Some other quantitative techniques also used by the Commission have included: (1) analysis of bidding data, both in a descriptive or regression modeling framework (e.g., Case M.7278—*GE/Alstom*, Comm'n Decision (Sept. 8, 2015), http://europa.eu/rapid/press-release_IP-15-5606_en.htm; Case M.7802—*Amadeus/Navitaire*, Comm'n Decision (Jan. 19, 2016), http://ec.europa.eu/competition/mergers/cases/decisions/m7802_817_8.pdf; Case M.7555—*Staples/Office Depot*, Comm'n Decision (Feb. 10, 2016), http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=2_M_7555), (2) reduced form regression modeling of prices and company size (e.g., Case M.6458—*Universal/EMI*, Comm'n Decision (Sept. 21, 2012), http://ec.europa.eu/competition/mergers/cases/decisions/m6458_20120921_20600_3188150_EN.pdf), or prices and concentration (e.g., Case M.6570—*UPS/TNT Express*, Comm'n Decision (Jan. 30, 2013), http://ec.europa.eu/competition/mergers/cases/decisions/m6570_20130130_20610_4241141_EN.pdf), and (3) partial correlation analysis of prices (e.g., Case M.4439—*Ryanair/Aer Lingus*, Comm'n Decision (June 27, 2007), http://ec.europa.eu/competition/mergers/cases/decisions/m4439_20070627_20610_en.pdf; Case M.6663—*Ryanair/Aer Lingus III*, Comm'n Decision (Feb. 27, 2013), http://ec.europa.eu/competition/mergers/cases/decisions/m6663_20130227_20610_3904642_EN.pdf).

[2] U.S. Dep't of Justice & Federal Trade Comm'n, Horizontal Merger Guidelines (2010), http://ftc.gov/os/2010/08/100819hmg.pdf.

[3] While merger simulation models typically cannot capture all important features of a market, their price predictions provide a useful and easy-to-interpret summary statistic of the complex interaction of important factors that they do take into account. (In simulations for differentiated product markets this typically includes the degree of substitutability between products in the market and the intensity of pre-merger price competition). This can provide a more concrete basis for the assessment than a more abstract discussion of individual inputs (for example, a discussion of whether observed diversion ratios are such that the transaction would likely lead to significant effects). The price predictions of merger simulations can also be useful as a tool to provide a certain degree of comparability across cases.

[4] Case M.6497—*Hutchison 3G Austria/Orange Austria*, Comm'n Decision (Dec. 12, 2012), http://ec.europa.eu/competition/mergers/cases/decisions/m6497_20121212_20600_3210969_EN.pdf; Case M.6992—*Hutchison 3G UK/Telefónica Ireland*, Comm'n Decision (May 28, 2014), http://ec.europa.eu/competition/mergers/cases/decisions/m6992_20140528_20600_4004267_EN.pdf; Case

M.7018—*Telefónica Deutschland/E-Plus*, Comm'n Decision (July 2, 2014), http://ec.europa.eu/competition/mergers/cases/decisions/m7018_6053_3.pdf; Case M.7419—*Teliasonera/Telenor/JV* (withdrawn Sept. 11, 2015), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2015:316:FULL&from=EN; Case M.7612—*Hutchison 3G UK/Telefónica UK*, Comm'n Decision (May 11, 2016), http://europa.eu/rapid/press-release_IP-16-1704_en.htm; Case M.7758—*Hutchison 3G Italy/Wind/JV*, Comm'n Decision (Sept. 1, 2016),http://europa.eu/rapid/press-release_IP-16-2932_en.htm.

[5] Case M.7421—Orange/Jazztel, Comm'n Decision (May 19, 2015), http://ec.europa.eu/competition/mergers/cases/decisions/m7421_3082_3.pdf.

[6] In the Austrian case (Case M.6497—*Hutchison 3G Austria/Orange Austria*, *supra* note 4), a simpler computation of illustrative price rises by each of the merging parties was presented by the Commission.

[7] A similar technique was applied by the Federal Communications Commission in its review of the AT&T/T-Mobile transaction in 2011. *See* FCC, Staff Analysis and Findings, WT Docket No. 11-65, http://www.wirelessestimator.com/publicdocs/ATT-TMO-FCC.pdf; see also Stanley Besen, Stephen Kletter, Serge Moresi, Steven Salop and John Woodbury, *An Economic Analysis of the AT&T-T-Mobile USA Wireless Merger, J. COMPETITION L. & ECON. (2013).* Price pressure techniques were used in a different context by the DOJ's expert witness in the recent *GE/Electrolux* merger (see M. Whinston, GE-Electrolux Merger Analysis, United States v. AB Electrolux, 1:15-cv-01039-EGS (D.D.C.) (Nov. 23, 2015), https://www.justice.gov/atr/file/ge-px02015/download).

[8] Eur. Comm'n, Guidelines on the Assessment of Horizontal Mergers Under the Council Regulation on the Control of Concentrations Between Undertakings 2004/C 31/03, ¶ 28 [hereinafter European Commission HMG], http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52004XC0205(02)&from=EN.

[9] Following a price increase by the merging parties, non-merging parties can also be expected to increase prices, given the reduced competitive pressure exercised by the merging parties. *Id*. ¶¶ 24–25.

[10] For a review of the role of diversion ratios in measuring closeness of competition and likely price effects, see T. Buettner, *Closeness of competition from an economic perspective*, J. EUROPEAN COMPETITION L. & PRACTICE (forthcoming).

[11] An assumption on the form of the demand function or the pass-on is required for the computation of the price effect. This is because the gross pressure to increase prices (as measured by the product of the diversion ratio and the profit margin, net of any efficiency) following a merger can be thought of as an effective "tax" on each merging party to induce it to set the optimal retail price post-merger. The degree to which this tax is passed on to final prices depends on the curvature of the demand curve. *See*, e.g., Joseph Farrell, and Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, B.E. J. THEORETICAL ECON., Vol. 10: Iss. 1 (Policies and Perspectives) (2010), http://faculty.haas.berkeley.edu/shapiro/alternative.pdf; E. Glen Weyl, and Michal Fabinger, *Pass-Through as an Economic Tool: Principles of Incidence under Imperfect Competition*, 121 J. POL. ECON. 528 (2013).

[12] The method described above (relying on observed diversion ratios, profit margins, and assumptions on the demand function) is referred to as *calibration*. An alternative method to quantify the parameters of a merger simulation model is through *demand estimation*. Here, the diversion ratios and demand elasticities are estimated using econometric methods from data on prices, quantities, and product characteristics. Using the Bertrand-Nash assumptions, these demand estimates are used to calculate the implied pre-merger equilibrium margins. The merger simulation is then performed in a similar way to the calibrated case. In some of the mobile telephony cases (Case M.7018—*Telefónica/E-Plus*, *supra* note 4; Case M.7419—*Teliasonera/Telenor*, *supra* note 4), as a

complement to the calibration based models, the Commission also relied on the results of demand estimation-based merger simulation models. For details and comparison, see Annex A of Case M.7018—*Telefónica/E-Plus*, *supra* note 4. This second technique is however more complex and burdensome than a calibrated merger simulation.

[13] Case M.6992—*Hutchison 3G UK/Telefónica Ireland*, *supra* note 4 (see, in particular, Annex I).

[14] *E.g.*, Case M.6992—*H3G/O2 Ireland*, *supra* note 4, ¶¶ 315, 578, 582; Case M.7018—*Telefonica/E-plus*, *supra* note 4, ¶ 493; Case M.7421—*Orange/Jazztel*, *supra* note 5, ¶¶ 334 and 360.

[15] The Commission used its merger simulation to balance the variable cost efficiencies in Case M.7421—*Orange/Jazztel*, *supra* note 5. For a more general discussion of the Commission's recent practice on efficiencies, see Benno Buehler & Guilio Federico,*Recent developments in the assessment of efficiencies of EU mergers*, COMPETITION L. & POL'Y DEBATE, Mar. 2016.

[16] *See* Robert Willig, *Unilateral Competitive Effects of Mergers: Upward Pricing Pressure, Product Quality, and Other Extensions*, 39 REV. INDUS. ORG. 19 (2011).

[17] The Commission's framework for the assessment of possible efficiencies is set out in European Commission HMG, *supra* note 8, ¶¶ 76–88.

[18] Case M.6471—*Outokumpu/Inoxum*, Comm'n Decision (Nov. 7, 2012), http://ec.europa.eu/competition/mergers/cases/decisions/m6471_14897_2.pdf.

[19] Case M.6905—*INEOS/Solvay/JV*, Comm'n Decision (May 8, 2014), http://ec.europa.eu/competition/mergers/cases/decisions/m6905_8118_2.pdf.

[20] For more details on the Commission's assessment of Case M.6471—*Outokumpu/Inoxum, supra* note 19, see Thomas Buettner, Giulio Federico, Kai-Uwe Kühn, Dimitrios Magos, *Economic Analysis at the European Commission 2012 – 2013*, 43 REV. INDUS. ORG. 265 (2013); for more details on the Commission´s assessment of Case M.6905—*Ineos/Solvay, supra* note 19, see Benno Buehler, Gábor Koltay, Xavier Boutin, Massimo Motta, *Recent Developments at DG Competition: 2013 – 2014*, 45 REV. INDUS. ORG. 399 (2014); and Andrea Amelio, Andrea Cilea, and Massimiliano Kadar, *INEOS / Solvay / JV: Yet another P(ractically) V(ery) C(omplex) merger,* Competition Merger Brief, 2/2015, http://ec.europa.eu/competition/publications/cmb/2015/cmb2015_002_en.pdf. The Commission's approach in both cases is also set out in Thomas Buettner, Andrea Cilea, Massimiliano Kadar, *Horizontal Mergers in Homogeneous Goods Industries: When Is Spare Capacity Sufficient to Offset Unilateral Effects?*, 39 WORLD COMPETITION 57 (Mar. 2016).

[21] For more information on some of the Commission's economic considerations in the assessment of remedies in Case M.6905—*Ineos/Solvay, supra* note 19, see Giulio Federico, Massimo Motta and Penelope Papandropoulos, *Recent Developments at DG Competition: 2014*, 47 REV. INDUS. ORG. 399 (2015).

[22] Case M.7292—*DEMB/Mondelēz/Charger Opco*, Comm'n Decision (May 5, 2015), http://ec.europa.eu/competition/mergers/cases/decisions/m7292_3753_2.pdf.

[23] An entry/exit analysis with a similar quantitative methodology was used in the earlier Commission decision of June 27, 2007, in Case M.4439—*Ryanair/Aer Lingus*, *supra* note 1. This case involved a merger between airline companies with an analysis of the impact of entry and exit on the pricing of airline tickets of the merging carriers.

[24] *See*, *e.g.*, Guido M. Imbens, and Jeffrey M. Wooldridge, *Recent Developments in the Econometrics of Program Evaluation*, 47 J. ECON. LIT., Mar. 2009, at 5;Orley Ashenfelter, and Daniel Hosken, *The effect of mergers on consumer prices: Evidence from five selected case studies*, 53 J.L. & ECON. 417 (2010); *see also* Luca Aguzzoni, Benno Buehler, Luca Di Martile, Georg Ecker, Ron Kemp, Anton Schwarz, and Robert Stil, *Ex-post analysis of two mobile telecom mergers: T-Mobiletele.ring in Austria and T-MobileOrange in the Netherlands*, (joint work of the Commission, the Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR), and the Netherlands Authority for Consumers and Markets (ACM)), http://ec.europa.eu/competition/publications/reports/kd0215836enn.pdf.

[25] Difference-in-differences models are most often implemented via econometric estimation of linear regressions. In a simple entry example, the (logarithms of) product prices are regressed on indicator variables of countries, time periods, as well as an indicator of whether the entrant had already entered the given market. The coefficient on the entry indicator is interpreted as the average percent price change due to the entry event. Econometric estimation can further extend the difference-in-differences method by including control variables when available and relevant (for example GDP or GDP per capita, exchange rates, or other measures of demand and cost conditions). Further variations might include for example market specific or time varying event impacts. (The latter case also allows inclusion of market specific time trends as control variables, *see*, *e.g.*, Justin Wolfers, *Did Unilateral Divorce Laws Raise Divorce Rates? A Reconciliation and New Results*, 96 AM. ECON. REV. 1802 (2006)).

[26] Mergers and entry/exit events are the outcomes of the strategic interaction between market players and the relatedly changing market conditions. It follows that, unlike in the case of "natural experiments," direct extrapolation from the impact of these past competitive events to those of future events may not be adequate. Rather, the Commission combines the direct estimation results with the other qualitative and quantitative evidence to assess the likely merger effects. For more on the academic debate on impact estimation and simulation models, see Joshua D. Angrist & Jörn-Steffen Pischke, *The Credibility Revolution in Empirical Economics How Better Research Design is Taking the Con out of Econometrics*, J. ECON. PERSP., Spring 2010, at 3; and Aviv Nevo, and Michael D. Whinston, *Taking the Dogma out of Econometrics: Structural Modeling and Credible Inference*, J. ECON. PERSP., Spring 2010, at 69.

[27] For more details on the Commission's assessment of Case /M.6905—*Ineos/Solvay, supra* note 19, Buehler et al., *supra* note 20; Amelio et al., *supra* note 20, at 5

[28] The Commission also used the transaction data in a separate quantitative analysis of the price divergence between the NWE and ROE regions. It was found that prices diverged significantly with the NWE prices increasing relative to those in ROE during 2007–2012, even after controlling for costs and customer composition effects. Moreover, during the same period, ROE producers' volume sold into NWE decreased. These findings, also corroborated by the qualitative evidence, indicated that the geographic market differentiation was strong enough that NWE and ROE be defined as separate markets within the EEA.

[29] For more details on the Commission's assessment of Case M.7292—*DEMB/Mondelēz*, *supra* note 22, *see also* Luca Di Martile, Szabolcs Lorincz, Jean-Christophe Mauger, Mauro Sibila, and Katarzyna Tosza, *Some like it hot! – coffee merger between DEMB and Mondelēz*, Eur. Comm'n, Competition Merger Brief, 2/2015, at 12,http://ec.europa.eu/competition/publications/cmb/2015/cmb2015_002_en.pdf.

[30] We will focus, for present purposes, on the aspects of the case related to single-serve coffee machines. The investigation, nevertheless, also involved an in-depth analysis of some of the multi-serve consumables markets, such as roast-and-ground (R&G) coffee, as well as the markets for filter pads and Nespresso-compatible coffee capsules. The merging firms offered commitments in the form of divesting important brands, licensing some others, and manufacturing capacity to address competition concerns in the Austrian, French, Danish and Baltic geographic markets of consumables.

[31] DEMB owns the Senseo trademark, while the corresponding machines are developed, produced, and marketed by Philips, with a Partnership Agreement with DEMB. Mondelēz created and owns the Tassimo trademark and system, with Bosch producing and marketing the machines. Nestlé owns and partly markets the Nespresso and Dolce Gusto trademarks and corresponding machines, using various machine manufacturers with various degrees of independence on design and development issues.

[32] The Commission defined an antitrust product market for single-serve coffeemachines, and separate antitrust product markets for each machine's consumables. (The geographic scope of each of these markets was found to be national.) The Commission then identified competition concerns on some of the single-serve consumables markets (filter pads, N-capsules). These concerns, inter alia, were addressed by the commitments offered by the merging firms. *See supra* note 30.

[33] A statistically significant estimation result refers to an estimation outcome that is unlikely to be due to chance or sample randomness alone. The Commission performed a series of robustness checks using various methods to calculate the statistical significance (applying the so-called robust-, cluster-robust, classic- and wild bootstrap methods of standard error calculation; the standard error is a measure of the accuracy of the estimate with higher standard error implying weaker statistical significance). The effects on Dolce Gusto were always statistically significant and stronger than those on Senseo. The effects on Senseo for some cases were statistically significant while for others non-significant. This further reinforced the conclusion that the main competitive constraint on Tassimo came from the Dolce Gusto systems.

[34] First, the effect of adding one or more country-specific control variables to the regression model was tested (exchange rate, coffee market overall price index, GDP, and GDP per capita). Second, to control for the relative strength of Senseo and Dolce Gusto, additional regression models were estimated where each observation was weighted by the population-proportional installed base of the respective system. This is to account for the possibility that a given type of machine's price reacts differently to the entry event in those countries where it already has a stronger position. Third, as discussed (*supra* note 33), the calculation of statistical significance was subject to robustness checking.