Title: Economics at the Antitrust Division: 2017–2018

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Abstract: This article describes some of the work of Antitrust Division economists over the past year, with a focus on modeling. It begins by illustrating the mapping from evidence to prediction using tools for assessing the effects of mergers using Bertrand, Cournot, and auction models. It then turns to two hot topics in competition policy: the implications of claims of increasing margins for merger enforcement and the validity of claims of increasing concentration. Finally, it considers how mergers affect prices in bargaining models.

Keywords: Antitrust · Bargaining · Concentration · Mergers

JEL Classification: C78 · K21 · L40

1. Introduction

Antitrust enforcement poses counter-factual questions, such as "what was the effect of that conspiracy?" These questions are difficult to answer because they compare two states of the world, but only one of the states is observed. Antitrust economists use models to draw inference about the unobservable counter-factual or "but for" world.

To illustrate, Figure 1 plots winning bids for frozen perch that were supplied to a Defense Department procurement depot before and after the collapse of a bid-rigging conspiracy. When the conspiracy collapsed in September 1989, the winning bids (solid line) fell and began to track the price of fresh perch, which was the biggest cost driver. An Antitrust Division statistician, working with Division economists, regressed winning bids on current and lagged fresh perch prices during the post-conspiracy period, then "backcast" non-collusive winning bids during the conspiracy period (dashed line). They estimated that the conspiracy raised prices by 23% (Froeb, Koyak, and Werden, 1993).

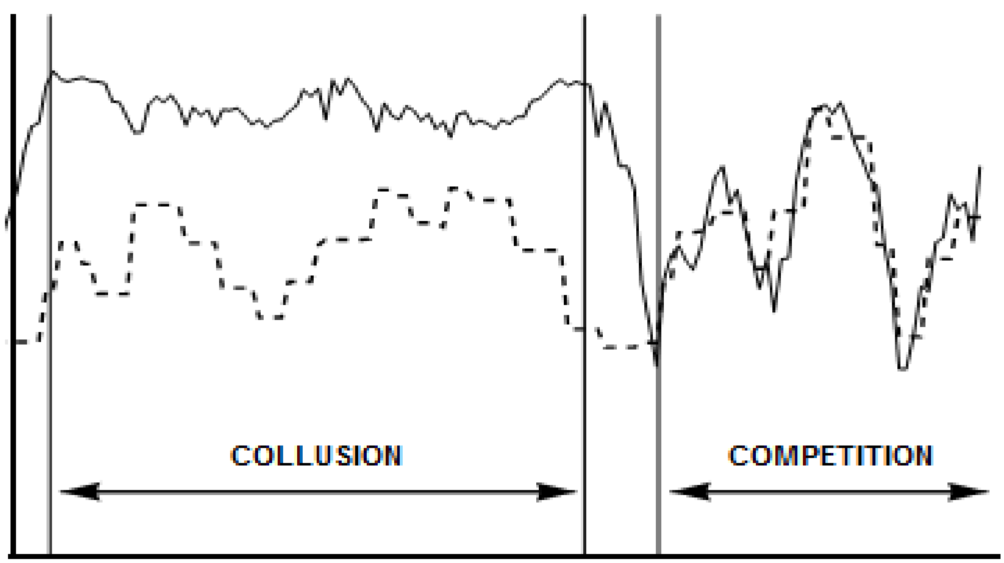

Fig 1. Actual and predicted winning bids for frozen perch filets

The estimate's credibility derives from the transparency of the modeling. The analysis was made replicable—and thus also subject to challenge—by providing a clear mapping from the data to the prediction of the but-for world. An opposing party could challenge the mapping or the data. That sort of scrutiny—and potential falsification—gives credibility to economic analysis and has elevated the role of economists and their models in antitrust.

Economics has not always played such a prominent role. Forty years ago, when the most senior of the authors began his career at the Antitrust Division, inference was primitive, drawn mainly from the Structure-Conduct-Performance paradigm, and supported mainly by cross-industry regressions of price or profit on industry concentration. In antitrust trials, it was not uncommon for opposing experts to opine about the effects of a merger based on little in the way of economic theory or empirical evidence, and without offering any mapping from either to their opinions. Economic analysis now occupies a central role in antitrust enforcement and credible expert opinions are derived from theoretical and empirical models.

This article describes some of the work of Antitrust Division economists over the past year, with a focus on modeling. It begins by illustrating the mapping from evidence to prediction for proposed mergers through the use of tools that were developed by Antitrust Division economists for predicting merger effects using Bertrand, Cournot, and auction models. It then turns to two hot topics in competition policy: the implications of claims of increasing margins for merger enforcement and the validity of claims of increasing concentration. Finally, it considers how mergers affect prices in bargaining models.

2. A Web Interface for Merger Simulation

2.1. Competitiontoolbox.com and the Antitrust R Package

The inclusion of unilateral effects in the 1992 Horizontal Merger Guidelines quickly led to the use of structural oligopoly models to predict the price effects from horizontal mergers. First-wave merger simulations involved differentiated consumer goods, with competitors that were assumed to play a Bertrand pricing game. Werden and Froeb (1994) and Werden (1997) simulated mergers with logit demand. Hausman et al. (1994) and Hausman and Leonard (1997) simulated mergers with an Almost Ideal Demand System (AIDS). Horizontal mergers subsequently were analyzed using second-*price* procurement auction models (Brannman and Froeb, 2000), as well as second-*score* procurement auction models (Miller, 2014). Versions of these models have been used in litigation, including the Bertrand pricing model in *H&R Block* (2011) and *Aetna* (2017), and the second-price auction model in *Sysco* (2015) and *Anthem* (2017).

Merger simulation, however, can become a protracted exercise in programing. The initial coding requires a certain level of expertise, and, as with any programming exercise, debugging benefits from repeated use in a variety of settings. All too often, the code for a specific implementation is used for only one or two cases. At most, a frequent repeat player in merger assessment might amass a small library of code.

Seeing the potential efficiencies of developing a package of tools, Antitrust Division economists, Charles Taragin and Michael Sandfort developed the Antitrust R Package (available at https://cran.r-project.org/web/packages/antitrust/index.html), which is an open-source suite of tools that implement many models used in merger simulation. The package provides easily used code to fit or calibrate standard models to observable data (prices, quantities, margins, and demand elasticities) and then use the calibrated models to predict post-merger prices or compute compensating marginal cost reductions (Werden, 1996; Froeb and Werden, 1998). Ideally, widespread use and re-use of the same code would let all users benefit from centralized coding with feedback from outside sources.

The Antitrust R Package is written in R, which is an open source programming language extensively employed by statisticians and economists, and which is free to download and modify. R is relatively easy to learn, and the Antitrust R Package is well documented and easy to use for those who know R. To allow wider use of the package, Charles Taragin designed a web interface to the Antitrust R Package. The interface allows users to utilize some of the package's functionality without learning R.[1]

Using the web interface is simple, but merger assessment is subtle and fact-intensive. Making the calculations simple does not relieve users of responsibility for assuring that all of the inputs to a simulation comport with the real world (Werden, Froeb, and Scheffman, 2004). The results of a merger simulation and their credibility can depend significantly on the quality of the choices that users make, which should be based on careful study of the industry and the data. The simplicity of using a web interface, however, facilitates experimentation with different models and parameters to determine the sensitivity of the predictions to particular user specifications.

After appropriate investigation and deliberation, users enter product-level quantities, prices, and some margin information into a table, select from lists of standard strategic interactions (e.g.,

[1] The Antitrust R Package includes functionality that is not currently accessible through the web interface. For instance, the web interface does not allow users to analyze partial ownership changes, the Bertrand model with linear or log-linear demand, or a second-*price* procurement auction model under different distributional assumptions for costs—all of which are capabilities of the Antitrust R Package.

Bertrand and Cournot) and demand specifications (e.g., logit and AIDS), and perhaps also specify an aggregate demand elasticity. At that point, the user simply pushes a Simulate button, and the code is executed. The chosen model is calibrated to the inputs, the post-merger equilibrium of the calibrated model is computed, and the user is presented with a table that provides the pre- and post-merger equilibria and the predicted effects of the merger. Also returned by the code is diagnostic information that can help assess how well the model fits the observable data and how reliable the model results may be.

The web interface also can help new users learn to code in R. Clicking on the R Code tab lets the user review and copy the R code that the web interface uses to import and fit the data, run the specified merger simulations, and report the results and diagnostics. This can also be a straightforward way to implement a single analysis to a batch of different markets, e.g., across a range of similar products or geographic markets.

While the web interface can be run on a user's personal computer from within R,[2] it can also be run on an organization's internal server using RStudio's Shiny Server software. The web interface is available at competitiontoolbox.com, which is hosted on a public server and thus is best suited for educational applications. Users should be careful about inputting confidential data at competitiontoolbox.com, as the service cannot guarantee that inputs will remain confidential.

2.2. Using competitiontoolbox.com with a Hypothetical Telecom Merger

To illustrate the interface, we simulate a hypothetical merger from a generation ago that involved

[2] R as well as the following R packages must be installed along with all of their dependent packages: antitrust, rhandsontable, and shiny R. Once these packages are installed, the R command line to run the web interface is: antitrust::antitrust_shiny().

what were then the two leading long-distance telephone carriers. The merger was originally modeled by Werden and Froeb (1994), who simulated the merger using a Bertrand model with six single-product firms.

Figure 2 is a screenshot of the web interface that the user would see after running the simulation and clicking on the Details tab. The predictions in lower-right table are within rounding error of those presented by Werden and Froeb (1994). On the left are the specifications for the simulation. The radio buttons specify that the simulation is performed using a Bertrand model that is calibrated with an aggregate elasticity and margins. The aggregate elasticity (–0.7) and demand model (logit) that were used by Werden and Froeb are specified in the two boxes. The data from Werden and Froeb has been typed into the Inputs table at the upper right. They did not report margins, but they did report an estimated coefficient on price of 29 in the indirect utility function. Using equation 14 from their paper (first-order conditions), the margins in the table are easily derived, and they imply own-price demand elasticities for the merging firms of roughly –2 and –4. In addition, the shares that they reported were converted into quantities with the use of FCC data, which indicates that the size of the market was $55.3 billion.

The table at the lower right in Figure 2 is one form in which the simulation results can be presented. If instead, the user clicked on the Summary tab, the table would show that: this merger would have increased the Herfindahl-Hirschman index (HHI) by 1,901 points to 6,070; industry prices would increase by 4.8% on average; and the prices of the merging parties' products would increase by almost 6.7% on average. The user also would see that the price increases would have caused $3.2 billion in annual harm to consumers (5.7% of pre-merger revenues) and yield $1.9 billion in annual additional profits for the carriers (3.4% of pre-merger revenues).

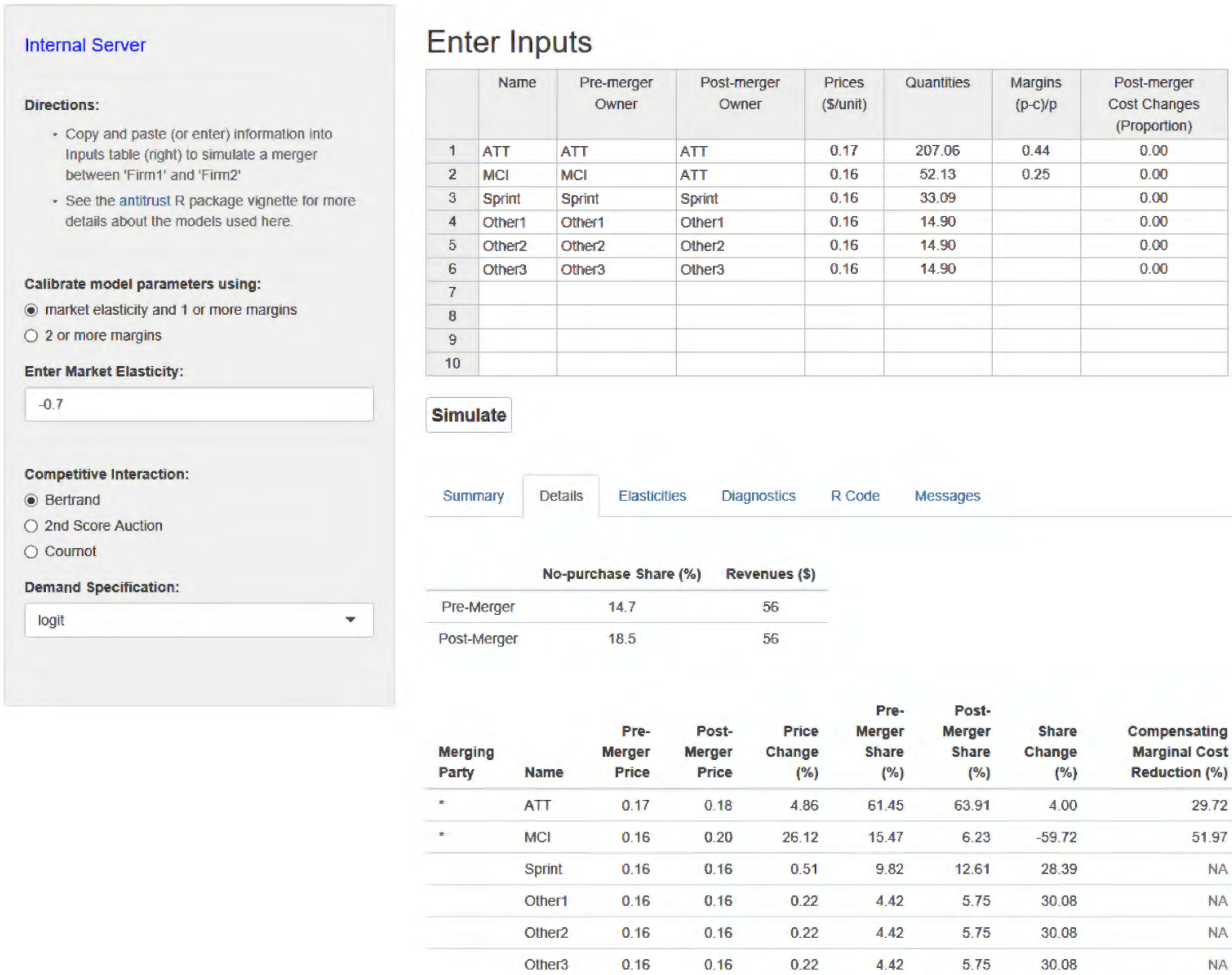

Fig 2. Image of competitiontoolbox Interface for Long-Distance Telephone Merger Simulation

3. Hot Topics in Competition Policy

3.1 Increasing Margins and Merger Enforcement

Recent academic research, most still unpublished, finds a substantial upward trend in price–cost margins across the U.S. economy. Economists in Europe (Padilla, 2018; Valletti and Zenger, 2018) argued that larger margins imply that any given market shares and diversion ratios for the merging firms lead to larger unilateral price increases. Antitrust Division economists (Werden and Froeb, 2018a) analyzed a standard model to show that their reasoning is not sufficiently nuanced.

When the merging firms sell close substitutes A and B, a rough first-order indication of the unilateral effect of a merger on the price of A is given by the product of two numbers: One is the diversion from A to B, as the price of A is increased, and the other is the price–cost margin earned on B. This product makes clear that *one effect* of larger margins is to increase the pressure for unilateral price increases. But whatever caused margins to be larger could have other effects that must be accounted for.

As always in comparative-statics analysis, results depend on what is being held constant and what varies. Valletti and Zenger (2018) posit no change in the number of competitors or market shares, and assume that margins are larger because the substitutability of products within markets has lessened. To get an idea of how that works, and what impact it has, we use competitiontoolbox.com to simulate a merger between two firms in a symmetric four-firm industry that is engaged in Bertrand competition. We assume that firms have margins of 40%, face a logit demand, and the aggregate elasticity is –1.5. Inputting the foregoing and clicking on the Simulate button, we see that the merger causes the merging product prices to increase by 4.8%. If the margins instead were 60%, with everything else unchanged, the price increases would be only 1.9%. Depending on other considerations, especially merger-specific efficiencies, the proper enforcement action could be to stop the merger if the margin is 40% but allow it if the margin is 60%.

To begin to understand this result, we had the interface display the implied demand elasticities, shown in Table 1. From the pre-merger first-order conditions for single-product, profit-maximizing firm, the implied own-price elasticities are –2.5 = –1/.4. The off-diagonal cross-price elasticities follow from the assumed aggregate elasticity of –1.5. Imagine that all the prices were increased by 1%: Product 1's quantity demand would decline (about) 2.5% as a result of the increase in its own price, but Product 1's quantity would increase by 1% from the increases in the other prices, to yield the net effect –1.5%. Because this is a symmetric industry, each product experiences the same 1.5% reduction in quantity demanded when all prices are increased 1%, making the implied aggregate elasticity –1.5 as assumed.

Table 1. Elasticity Matrix with Margins of 40%

	Product 1	Product 2	Product 3	Product 4
Product 1	–2.50	0.33	0.33	0.33
Product 2	0.33	–2.50	0.33	0.33
Product 3	0.33	0.33	–2.50	0.33
Product 4	0.33	0.33	0.33	–2.50

Table 2 below displays the pre-merger elasticity matrix for the industry with margins of 60%. The implied own-price elasticities of demand are –1.67 = –1/.6. To maintain an aggregate elasticity of –1.5, the cross-price elasticities must decline all the way to 0.06. These much lower cross-price elasticities mean that there is less competition between the firms for a merger to eliminate. Consequently, the merger's effect on prices is smaller.

Table 2. Elasticity Matrix with Margins of 60%

	Product 1	Product 2	Product 3	Product 4
Product 1	–1.67	0.06	0.06	0.06
Product 2	0.06	–1.67	0.06	0.06
Product 3	0.06	0.06	–1.67	0.06
Product 4	0.06	0.06	0.06	–1.67

Redoing all of the foregoing with a much lower aggregate elasticity of demand—say –0.5—changes things a great deal. The merging products' prices increase by 9.7% if the margins are 40%, but those prices increase by 12.4% if the margins are 60%. Although the merging products still become worse substitutes as the margins increase, with much less elastic aggregate demand, the increase in margins has much less effect on the cross-price elasticities of demand, and that effect is no longer the dominant factor in the comparative-statics analysis.

In general, the combination of a relatively low aggregate demand elasticity (in absolute terms) and relatively low margins creates an environment in which increased margins increase unilateral price effects from mergers. But the combination of a relatively high aggregate demand elasticity and high margins creates an environment in which increased margins decrease unilateral price effects from mergers. Models allow us to sort out which of the effects dominates.

3.2 Increasing Concentration

A report by the Obama Administration's Council of Economic Advisers (2016) pointed to indications of "a decline of competition" and particularly to rising concentration as indicated by data from the U.S. Census Bureau. Work done in the past year at the Antitrust Division (Werden

& Froeb 2018b) showed that these indications were highly misleading because even the least aggregated Census "industry" is apt to be over a hundred times more broader than the relevant "markets" in which firms compete (i.e., the volume of commerce in the former is more than a hundred times that of the latter). Although market concentration is a useful indicator of competition, Census industry data are far more aggregated than are the relevant markets.

Empirical industrial organization research once consisted largely of inter-industry analyses of manufacturing industries. The analyses employed data at the 4-digit level of the Standard Industrial Classification (SIC) system. Economists asked whether the level of aggregation in the data reasonably comported with markets, but they lacked a sound basis for providing the answer until a systematic approach to the delineation of relevant markets in antitrust cases was developed.

Things changed in 1982 when the Merger Guidelines that were promulgated by the U.S. Department of Justice adopted the hypothetical monopolist paradigm. Markets delineated under the Guidelines became a benchmark for evaluating SIC 4-digit industries. Research done at the Antitrust Division in the late 1980s (Pittman and Werden, 1990) found that SIC 4-digit industries commonly were at least a hundred times broader than relevant markets that were alleged in merger complaints.

The North American Free Trade Agreement led to a new system for compiling economic data, and Census data from 2002 onward uses the North American Industry Classification System (NAICS). NAICS divides the economy into 24 2-digit sectors, 99 3-digit subsectors, 311 4-digit industry groups, 709 5-digit industries, and 1057 6-digit industries. The NAICS 6-digit industries are somewhat coarser than were the SIC 4-digit industries. Manufacturing had been divided into 450 SIC 4-digit industries but is now divided into 360 NAICS 6-digit industries.

To get a clear picture of how NAICS 6-digit industries compare to meaningful markets, Antitrust Division economists (Werden and Froeb, 2018b) repeated the analysis from 30 years earlier for the relevant markets that were alleged in mergers complaints filed by the Justice Department during fiscal years 2013–15. The NAICS 6-digit industries were at least a hundred times broader than 73% of the alleged relevant markets.

The average degree of overbreadth for the NAICS 6-digit industries in comparison to relevant markets that were alleged in merger complaints is greater than that found three decades ago primarily because the earlier comparison considered only manufacturing industries. The new comparison also included non-manufacturing industries, which often have local markets, and which had much merger activity. Among the relevant markets in the merger complaints examined are several for crushed stone, film exhibition, radio advertising, and waste management. All have local relevant markets, while the Census data are national. And while the NAICS 6-digit industries typically are far broader than markets, the CEA used data for NAICS 2-digit sectors—which are broader still.

Although concentration is measured with error, some commentators that relied on Census concentration data have suggested that trends in the data are meaningful nonetheless; but simple thought experiments that were formulated by Antitrust Division economists (Werden and Froeb 2018b) show that concentration trends for market aggregates are unlikely to be informative of concentration trends in the underlying markets. These experiments posit particular compositions in 1998 and 2018 for NAICS 3-digit subsectors, on which some academics (e.g., Grullon et al. 2018) have focused in identifying concentration trends. Each subsector is assumed to encompass ten relevant markets. For the first experiment, each market is assumed to have ten firms in 1998, so the market-level HHIs start out at 1,000, and the 3-digit-sector-level HHIs start out at 100.

Suppose that, between 1998 and 2018, one firm in each market acquired every other firm in its market. The result would have been monopoly in every market. Although excessive aggregation would produce a huge bias in measured concentration, that bias would not affect the trend: The true market-level HHIs and the biased 3-digit-sector-level HHIs both would have increased tenfold between 1998 and 2018.

However, this need not be the case. Consider instead the possibility that all the mergers were non-horizontal—that each firm in one market acquired one firm in every other market within its subsector. In this case, the true market-level HHIs did not change, but the observed 3-digit-sector-level HHIs increased tenfold. Although horizontal and non-horizontal mergers have completely different effects on market concentration, they often have exactly the same effect on concentration in NAICS 3-digit subsectors. For the many NAICS 6-digit industries with local markets, horizontal and non-horizontal mergers also often have the same effect.

Excessive aggregation also leads to fallacies that are associated with averaging. To see this, change the experiment so that, in 1998, half of the markets in each subsector had five equal-sized firms and half had ten equal-sized firms, and assume that the former firms were twice the size of the latter, so all markets were of equal size. Suppose now that there were no mergers since 1998, and that no market shares changed, but the five-firm markets all grew twice as fast as the ten-firm markets. The true market-level HHIs would be unchanged, but the 2018 subsector HHIs would be 200, up 33% from 150 in 1998. Changes in composition of the economy easily can lead to changes in subsector concentration without corresponding changes in market concentration.

Subsector concentration also can increase even if the concentration of every market in a subsector decreases. Suppose everything is the same as in the second thought experiment except that every market experienced entry: In particular, the five-firm markets end up with six equal-sized firms; and the ten-firm markets end up with 12 equal-sized firms. Every market in the economy is now less concentrated; the true market-level HHIs in 2018 are 1,667 and 833, down from 2,000 and 1,000 in 1998. But the change in subsector composition due to the faster growth of the more concentrated markets causes every subsector to be more concentrated; the HHI for every subsector has increased from 150 to 167.

4. Mergers in Bargaining Models

4.1 Introduction

Economists sometimes use bargaining models to analyze bilateral exchange and to predict the effects of mergers (Nevo, 2014). This section describes, with simple examples, insights from bargaining theory on how mergers affect competition. The examples show that predictions are sensitive to a particular bargaining model's assumptions. This raises the question of reliability of the predictions in merger cases: When predictions depend on assumptions, it is important to determine how well the particular model "fits" the case or industry to which it is applied (Werden et al., 2004).

The central insight of bilateral bargaining theory (Nash, 1950)—that a party with the better outside option gets a bigger share of the proverbial pie—can be applied to bargaining among several parties, as when two hospitals bargain with a payer (insurer) network, or Coke and Pepsi bargain with a retailer. The characteristic feature of these models that gives rise to merger effects is that the profits that are generated by one bilateral agreement—as between a hospital and a payer or between a soft drink manufacturer and the retailer—are affected by any other agreements that the payer or the retailer has, or could have, with the rival hospital or soft drink manufacturer. For now, we assume that parties bargain efficiently (as with two-part pricing), and briefly outline the two main approaches to this kind of bargaining, and what they imply for mergers. We end the section by discussing inefficient bargaining (as over a single wholesale price), in which the bargaining split, in part, determines how much profit is split.

4.2 Nash-in-Shapley Solution

We first illustrate the "Nash-in-Shapley" solution (Stole and Zwiebel, 1996; de Fontenay and Gans, 2014; Froeb et al., 2018) with the example of patentee A bargaining with licensees R_1 and R_2. The licensees produce substitute products that can be produced only under license from A. The model has two linked stages: In the "Shapley" bargaining stage, parties negotiate over licensing terms, for example, over a marginal royalty (which could be zero) and a fixed fee. In the "Nash" performance stage, licensee payoffs are determined through a Nash competitive process, such as a Bertrand pricing game. The bargaining stage affects the performance stage only through any potential downstream price effects.

To make this concrete, and simple, imagine that there are five ultimate customers for the products in question and that each purchases one unit. One customer will buy only from R_1; one customer will buy only from R_2; and three "switchers" will buy from either. If each sale yields 2 units of profit, profits are generated according to the following rule:

0, if no agreements are made,

8, if A reaches agreement with only R_1 or only R_2,

10, if A reaches agreement with both R1 and R2.

The presence of the switchers makes the products substitutes, and the fact that the products of R_1 and R_2 are substitutes places A in a position to capture most of the profit.

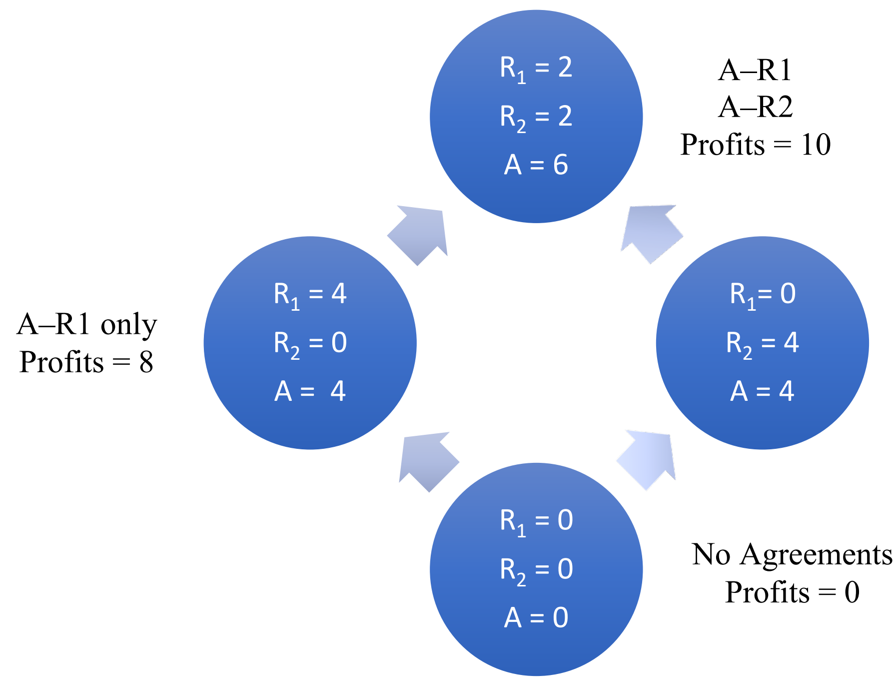

Fig 3. Bargaining Between Patentee A and Licensees R_1 and R_2

How this occurs is illustrated by Figure 3, in which the disks denote the four possible combinations of agreements, and in which the symbols for the three parties serve also as symbols for their profits. Lower disks are the "threat points" or "alternatives to agreement" for higher disks. We begin at the bottom: When no agreements are reached, there are no profits, as indicated by the text in the bottom disk. If A reaches agreement with only R_1, denoted by the left disk, A and R_1 equally split the gains from agreement relative to the threat point at the bottom disk. The resulting profits are $A = R_1 = 4$. Similarly, if A reaches agreement with only R_2, represented by the right disk, the profit split is $A = R_2 = 4$.

In the top disk, the patentee reaches agreements with both licensees, simultaneously using the threat of agreement with each licensee alone (left and right disks) to extract concessions from the other. For example, when A bargains with R_2, A's outside alternative is agreement with R_1, which pays 4. In contrast, R_2's outside option pays 0 because A is a "pivotal player," with whom agreement is necessary to generate profit (Raskovich, 2002). With these threat points, A gets 4 more than R_2, $A = R_2 + 4$. Similarly, when A bargains with R_1, A uses agreement with R_2 as a threat point that pays 4. As above, R_1's threat point pays 0. With these threat points, A gets 4 more than R_1, $A = R_1 + 4$. In the top disc, A reaches agreements with both R_1 and R_2. The total profit of 10 is distributed among the three of them, which gives us a third equation—$A + R_1 + R_2 = 10$—to solve for the profit split: $A = 6$; $R_1 = R_2 = 2$.

The Nash-in-Shapley solution builds up threat points recursively, derived from the assumption that the alternatives to agreement between any two players are those that obtain absent the agreement. Because the terms of an agreement are contingent upon which other agreements can be reached, when one agreement changes, the terms of other agreements change as well. As such, the Nash-in-Shapley solution is sometimes viewed as describing long-run equilibrium, in which agreements have time to adjust to one another.

The foregoing explains how the patentee uses the threat of agreement with only one licensee to extract concessions from both licensees. The model tells us:

1. what matters: the degree of substitutability between the two products;
2. why it matters: greater substitutability improves A's threat points; and
3. how much it matters: what share of the profit A captures.

We are now in a position to understand how mergers affect the bargaining outcome. Imagine that R_1 and R_2 merge before the bargaining. They bargain jointly with A over the surplus created by both agreements. Post-merger, the gains would be evenly split between A and the merged licensee; each side gets 5. The merger is profitable because the post-merger profit of

5 for the merged licensees exceeds their combined pre-merger profit of 4. Horizontal merger improves R_1 and R_2's bargaining position by eliminating the ability of the A to use the threat of agreement with just one licensee to extract concessions from the other. And this is why such a merger may be challenged by the antitrust agencies as anticompetitive.

4.3 Comparison to the Nash-in-Nash Solution

In contrast to Nash-in-Shapley, the Nash-in-Nash solution derives threat points under the assumption that other agreements are given. The Nash-in-Nash solution is viewed more as a short-run solution, with each agreement reached before other agreements can adjust.

To derive the Nash-in-Nash pre-merger equilibrium in the simple 1×2 case, first consider bargaining between A and R_1. A and R_1 take the agreement between A and R_2 as given, so the incremental surplus is 2, which is equally split, so $R_1 = 1$. A similar analysis indicates that $R_2 = 1$, with A = 8. The payouts to the R_1 and R_2 are smaller because the pivotal player is splitting less incremental surplus with each player.

Now imagine that R_1 and R_2 merge before the bargaining begins. They bargain with A jointly, and get half of the profit created by the agreement. Post-merger, the gains from agreement would be evenly split between the A and the merged licensee; each side gets 5. In Nash-in-Nash solution, the merger increases the combined profits of R_1 and R_2 from 2 to 5, rather than from 4 to 5 in the Nash-in-Shapley solution. A horizontal merger between R_1 and R_2 is more profitable in the Nash-in-Nash solution than in the Nash-in-Shapley solution simply because there is more pre-merger competition to eliminate.

To dramatically illustrate this last point, imagine that the products are perfect substitutes, with all five consumers being switchers. In this case, the Nash-in-Nash solution is A = 10 and

$R_1 = R_2 = 0$; A captures the entire surplus. In contrast, the Nash-in-Shapley solution is $A = {}^{20}/_{3}$; $R_1 = R_2 = {}^{5}/_{3}$. The non-zero payoffs to the licensees can be thought of as payments for acting as threat points for the pivotal player in negotiations with the rival players. In other words, there is more competition to eliminate in Nash-in-Nash than in Nash-in-Shapley.

4.4 Bargaining over Profit Determined in a Performance Stage

So far, we have suppressed the link between the bargaining stage and the performance stage in which profit is determined; we have implicitly assumed that the bargaining split does not affect the amount available to split. This need not be the case. Consider an example of a manufacturer that bargains with two retailers over a single wholesale price. In this case, the parties have only one instrument to determine both how profit is split as well as the size of the profit that is available to split. For example, a higher wholesale price has two effects: It increases the profit share of the upstream manufacturer, but it also results in a higher retail price, which can reduce the profit that is generated from the agreement via double marginalization. In these cases, the bargaining must be worked out on a case-by-case basis, i.e., numerically as in Sheu and Taragin (2017). Froeb et al. (2018) find that the substantial differences between Nash-in-Nash and Nash-in-Shapley outcomes when parties split a fixed surplus (illustrated above) can disappear when parties bargain over a wholesale price and profit is determined by a retail pricing game. In their examples, the downstream retailer exercises its bargaining power by demanding a lower wholesale price, which increases the size of the proverbial profit pie by attenuating the double marginalization problem, and the differences between Nash-in-Nash and Nash-in-Shapley models are smaller.

Bargaining over a single wholesale price can also increase the scope for anticompetitive effects from vertical mergers relative to the familiar double marginalization models. For example, if the upstream firm has all of the bargaining power and sets the wholesale price to maximize its own profit, while anticipating how the downstream firms will react, a vertical merger reduces the wholesale price to the captive downstream firm ("elimination of double marginalization"). This puts downward pressure on a downstream rival's demand and on the wholesale price that is charged to the rival. However, the merger also creates an incentive for the merged firm to raise wholesale price to its unintegrated rival ("raising rival's cost"). Because the elimination of the double-marginalization effect is smaller when downstream firms have some bargaining power, the scope for anticompetitive vertical mergers is increased.

Antitrust Division economist Russell Pittman and two of his students developed some evidence on the elimination of double marginalization in railroad pricing (Alexandrov et al., 2018). They examined confidential pricing data from the Surface Transportation Board for long-distance shipments of coal and found no significant difference between rates charged by: (*i*) unintegrated railroads that "interlined" to provide the service; and (*ii*) integrated railroads that provided comparable service on a single-line basis. The authors suggest that this result is consistent with the hypothesis of efficient bargaining in setting rates for interlined rail shipments: There is no double marginalization to eliminate. If so, this finding would imply that "end-to-end" (vertical) railroad mergers would not produce benefits from the elimination of double marginalization. This finding contrasts with that of Crawford et al. (2017), who find that vertical integration between regional sports networks and cable TV distributors results in increased geographic distribution of the networks and a corresponding increase in consumer and total welfare.

5. Conclusion

Antitrust Division economists use economic models to understand competition and its implications and to predict the effects of mergers and business practices. Each year brings new cases and hence new markets to analyze and new opportunities to refine the practical application of the tools of economics. This past year was no exception.

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