

CPI Antitrust Chronicle

March 2011 (1)

Use and Misuse of Empirical Methods in the Economics of Antitrust

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I. INTRODUCTION

The application of economics to issues involving competition policy has always required a mixture of economic theory and empirical analysis. As any good lawyer knows, an economic analysis typically must rely on the facts of the industry under study to be credible. As a result, empirical analysis is often a crucial component of any economic analysis of competition issues. Of course, any empirical analysis has to be grounded in some theoretical structure. Over the last decades, there have been tremendous advances in both economic theory and empirical applications related to antitrust analysis. The law, although initially quite divorced from economics, has come to rely heavily on such analysis. In this paper, I discuss some of the theoretical and empirical strengths and weaknesses of the approaches to antitrust analysis, including a critique of some of the recent methods.

Section II discusses two of the most basic concepts in antitrust analysis, market definition and price cost margins, and highlights some relatively unrecognized subtleties that lead to common and serious errors. Section III discusses some insights that alter how we think about competition and emphasizes limitations of traditional analysis when competition involves something other than price. Section IV discusses some of the most recent advances in empirical economics including the estimation of demand systems. The main use of these advances has been in the area of mergers, especially in the use of merger simulation and the recent discussions in the United States about the use of an analysis called “upward pricing pressure” (“UPP”). The bottom line is that these new techniques can be helpful but should not displace some others without more research. Finally in Section V, I conclude with a discussion of how one could study the effectiveness of various methods of empirical analysis related to antitrust, but such a study would likely require the cooperation of competition authorities around the world.

II. BASIC EMPIRICAL TOOLS

Two of the most basic tools of empirical analysis in antitrust are market definition and the calculation of price cost margins. Though used for a long time, each has serious limitations, some of which are not fully appreciated.

A. Market Definition

Market definition typically is used to see whether the firm or firms under analysis have the ability and incentive to exercise market power, which typically means the ability and incentive to charge a price above the competitive level. In a merger case, the precise question is whether, after the merger, the merged firm would raise price above the current level (or the level

¹Katherine Dusak Miller Professor of Economics, Booth School of Business, University of Chicago; NBER; and Compass Lexecon. This paper is based on the keynote address given to The Annual Conference of the Competition Law and Policy Institute of New Zealand (August, 2010). I thank Mark Israel, Gregory Pelmar, and E. Glen Weyl for helpful comments.

that would otherwise have prevailed). In an antitrust case alleging bad conduct, at least in the United States, the first question often is whether the firm alleged to have engaged in bad conduct has (any) market power and, if so, whether the conduct complained about enabled it to acquire more market power (or maintain its power) and set price above the level that would have prevailed absent the allegedly bad conduct, all else equal.

These questions reveal what the purpose of market definition is. The market should be defined so that market shares (or changes in market shares) are meaningful predictors of prices (or change in prices). That is, in a properly defined market, a high market share should indicate some ability to set price above competitive levels and a merger between two firms each with high market shares should indicate that the merger will lead to a price increase.

How then does one figure out what is included in market definition? Well, a standard definition is to include all products whose presence constrains the price of the product at issue. This is easier said than done. The *U.S. Merger Guidelines* do suggest a framework that could, under some assumptions, be implemented empirically.² One such approach goes roughly as follows:

Estimate econometrically the demand curves facing each firm. Assume that firms in an industry compete according to a particular model of competition (*e.g.*, static Bertrand). Start with some small group of products, using a merger simulation (I will discuss merger simulation in more detail in Section IV), ask whether the price would rise by, say, 5 percent if there were a merger to monopoly. If not, add the next closest product and repeat the analysis.

I have discussed in detail certain issues associated with this procedure elsewhere,³ but here I note two points. First, no one does this. That does not mean it is a bad thing to do, just that the analytic precision that could be used to analyze the problem is typically not used. Second, and perhaps more fundamentally, if one were to do it in, say, a merger case, the question is why. If one believes the assumptions needed to implement this procedure, *i.e.*, one believes that a merger simulation can be done, then what is gained by defining a market and calculating market shares to predict whether post merger prices will rise compared to doing a merger simulation and observing what is the prediction of the post merger prices?

Matters are even worse in non-merger cases where the issue is whether a firm already has market power (though as discussed above, a proper—indeed arguably the only relevant—question is whether the bad conduct increased (or maintained) market power). To answer whether there is market power, the sole question is whether price is above the competitive level. But if the competitive level is not known, there is (except in some special cases)⁴ no easy way to answer this question even after a detailed demand system has been estimated, unless again one is willing to specify a model of competition such as Bertrand. As was true for the case of mergers, this procedure is typically not followed in non-merger antitrust cases.

If these analytical approaches to defining markets are not followed, what approaches are followed? The answer is that market definition is based on a variety of evidence all designed to

² For a clear exposition of the approaches and underlying assumptions, see Gregory J. Werden, *Market Delineation Algorithms Based on the Hypothetical Monopolist Paradigm*, Economic Analysis Group Discussion Paper No. 02-8, Antitrust Division, U.S. Department of Justice (July 27, 2002).

³ Dennis W. Carlton, *Market Definition: Use and Abuse*, 3(1) COMPETITION POL'Y INT'L (2007).

⁴ *Id.*

determine products whose presence closely constrains the price of the product under analysis. Consumer responses or business documents showing available substitute products, some evidence of pricing correlations among products, or consumer switching are among some of the types of evidence used. But the bottom line is this: Market definition is a crude exercise designed to give some inkling to the analyst as to what is going on.

If market shares are to be meaningful, as described earlier, they must possess the property that they are somehow useful in predicting price. Suppose that there are two areas. In one, arrange for there to be high market concentration and in the other low market concentration. For market definition and shares to be useful, then the margins should be higher in the first area. (There is an important subtlety here that I return to in the next section.) This means that whether a particular market definition makes sense can be confirmed by an appropriate econometric test of its predictive value.

Although I have indicated that market definition is a crude concept, it has one overwhelming advantage. Assuming it is sensible—perhaps confirmed by an appropriate econometric test—it is easy to use. One does not need a Ph.D. in economics to understand how to use it once it has been established. This means that courts or competition authorities not staffed with lots of highly trained economists can have some grounding in making antitrust decisions. To eliminate market definition and replace it with the more sophisticated methods that I discuss later may be fine for antitrust authorities with lots of well trained economists, but would likely lead to arbitrariness and discretionary havoc in courts and at agencies where economics is poorly understood. Therefore, though I recognize its severe limitations, market definition—based on a variety of (sometimes qualitative) evidence as to which products constrain price, perhaps combined with a confirming econometric analysis—should remain an important tool for antitrust analysis.

B. Price Cost Margins

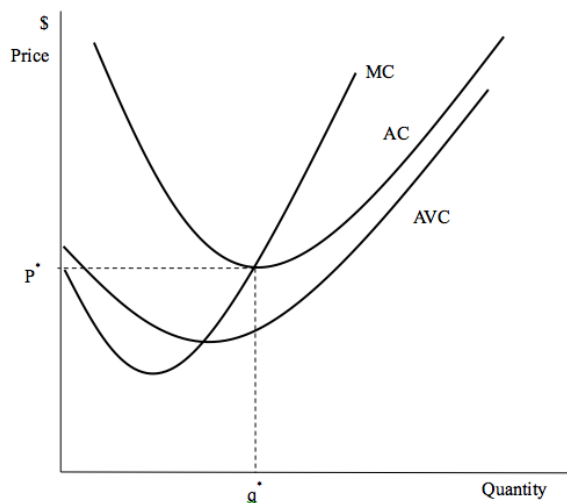
A typical measure of industry performance is its price cost margin or its rate of return. If one of these measures is estimated to be above competitive levels, then the industry is judged to exhibit market power. Recall though that in a merger case, the relevant issue is whether **more** market power will be exercised as a result of the merger, while in a “bad conduct” case the issue is whether the bad act allowed **more** market power to be exercised than would have otherwise occurred.

Although once popular, it is rare for analysts to calculate rates of return to see whether they are above competitive levels. In part, this diminished popularity comes from certain accounting difficulties in doing such a calculation. There are similar accounting problems in calculating margins and, indeed, some aspects of the economic literature seek methods that pay no attention to either rates of return or price cost margins in performing any analysis of market power.⁵ Recently, the importance of price cost margins has enjoyed somewhat of a resurgence because of the new proposed U.S. Merger Guidelines, which express the view (correct under certain circumstances) that a high price cost margin can indicate market power. Indeed, if one views the price cost margin as a test for whether price exceeds marginal cost, then it is the perfect test for whether there is market power.

⁵ See, e.g., Timothy Bresnahan, *Empirical Methods for Industries with Market Power*, HANDBOOK OF INDUSTRIAL ORGANIZATION, Vol. II, (R. Schmalensee & R. Willig, eds.)(1989).

I point out one serious flaw in the use of price cost margins. Economists are interested in price minus marginal cost, where marginal cost (“MC”) is the incremental cost of producing and selling one additional unit of output. Typically, that is not what companies keep track of. At best, if one could remove various capital charges from the reported accounting measures, one obtains average variable cost (“AVC”). To see what difference it makes to use AVC rather than MC, consider Figure 1 below, which illustrates the cost curves of an individual firm shown in textbooks.⁶ A standard result is that in long run competitive equilibrium, each firm produces output q^* and that the equilibrium price, P^* , equals the marginal cost associated with q^* but **exceeds** the average variable cost associated with q^* . Therefore, the analyst who uses AVC instead of MC will conclude that there is market power even though there is none. Those who use price cost margins had better understand this limitation; otherwise they will overestimate the frequency of market power, even in those instances where price is the only focus of competition.

Figure 1



III. THEORETICAL ADVANCES WITH IMPORTANT EMPIRICAL APPLICATIONS

The traditional focus of industrial organization economists and antitrust lawyers on price competition can lead to a mistaken view of the competitive process. Anytime competition involves more than just price competition then traditional tests for market power based on market shares or the existence of a high price-cost margin may mislead the analyst as to the state of competition.

For example, suppose that in addition to price, consumers also care about the availability of the product. Some stores charge a high price but hold lots of inventory while others charge a low price but hold little inventory. In this setting, competition occurs along two dimensions, price and availability. The store with lots of inventory will, at the end of the day, often have inventory unsold. This raises its costs and, therefore, just to break even, its price must exceed its wholesale cost of the goods. To interpret this as a sign of market power would be an error.

⁶ See DENNIS W. CARLTON & JEFFREY M. PERLOFF, *MODERN INDUSTRIAL ORGANIZATION*, 4th Ed. at 59 (2005).

Similarly, if firms compete not just on price but on quality of the product, and if there is a fixed cost to developing quality then, again, even when firms earn zero profits, there will be a positive gap between price and marginal production cost.

Perhaps the most important example of non-price competition involves the introduction of new products. As long as product development is costly, there needs to be a positive margin between price and marginal production cost in order to create the incentive to bring new products to market. Empirical methods of antitrust analysis have had a hard time dealing with non-price competition. Possible solutions such as using “innovation markets” to deal with industries where innovation is central have generally failed to provide much reliable guidance.⁷

Perhaps the most important contribution to the recent literature on non-price competition is Sutton⁸ who shows empirically not only how non-price competition and entry matter but, more importantly, shows how the intensity of competition interacts in a subtle way to produce some initially paradoxical results.

To understand the importance of Sutton’s contribution, let us focus on entry. Sutton starts by observing that in many markets entry will occur until profits are driven to zero. To keep matters simple, suppose that each firm incurs a set-up cost of F and then produces at constant marginal costs. Consider situation 1 in which the firms all join a cartel and charge the monopoly price. Notice that as more firms enter, the optimal price is unchanged. It remains at the monopoly point.⁹ Firms will enter the industry as long as profits are positive. Hence, the equilibrium number of firms, N^* , will equal π^*/F where $\pi^* = (p^* - c) Q(p^*)$ where p^* = monopoly price and $Q(p^*)$ is the amount demanded at the monopoly price. When there are N^* such firms in the industry, then all profits in the industry will be eliminated and there will be no further incentive for entry. In contrast, consider situation 2 where firms do not behave as a cartel—*i.e.*, compete amongst themselves more vigorously than in a cartel—then the total industry profit will be less than π^* and therefore the industry cannot support as many firms as N^* .

The startling implication of Sutton’s work is this: In situation 1, where competition is not intense (a cartel), the gap between price and marginal cost is high, yet the industry has lots of firms. In contrast, in situation 2, the gap between price and cost will be lower than in situation 1, yet there will be fewer firms and a more concentrated industry structure. That is, in equilibrium, price and concentration are inversely related!

Sutton’s work emphasizes that one must understand the relationship between entry and the intensity of competition in order to assess what relationship there will be between price and concentration. One must ask why concentration differs between situation 1 and 2 if one wishes to draw inferences about any relationship between price and concentration. In the example I just gave, the intensity of competition differed and that gave rise to the differing level of concentration, leading to the inverse relationship between price and concentration.

⁷ See Dennis W. Carlton & Robert Gertner, *Intellectual Property, Antitrust and Strategic Behavior*, INNOVATION POLICY AND THE ECONOMY (A. Jaffe, J. Lerner & S. Stern, eds.) (2003).

⁸ JOHN SUTTON, SUNK COSTS AND MARKET STRUCTURE: PRICE COMPETITION, ADVERTISING, AND THE EVOLUTION OF CONCENTRATION, (1991) and TECHNOLOGY AND MARKET STRUCTURE: THEORY AND HISTORY, (1998).

⁹ The cartel will set price so that marginal revenue equals marginal cost. Marginal revenue depends only on industry demand while marginal cost is (by assumption) constant. Hence the cartel price does not change as additional firms enter the industry.

Sutton makes clear that the experiment most economists have in mind when studying price versus concentration is to keep the intensity of competition (the competitive game—*e.g.*, Cournot, Bertrand) constant and then change the number of competitors. One way the number of competitors might differ, say across cities, is that the cities might be of different sizes so more firms can be supported in a big than small city, all else equal. In such a case, a graph of price against number of firms will show that there is the usual relation between price and concentration with price falling as the industry becomes less concentrated.

Sutton's work stresses the need to understand and econometrically deal with the reason the concentration of an industry differs either across space or time. This is referred to as the endogeneity problem associated with concentration. Without econometrically accounting for this problem, one could easily mistakenly estimate the inverse relation between price and concentration and conclude that competition is bad.

There is one other twist to Sutton's work that merits mentioning. In cases where firms compete on not just price but other dimensions such as product quality, Sutton shows a rather startling result. In such industries, as the market grows (and therefore from the prior example one might think that more firms would enter and drive price down) instead of more firms entering, the existing firms improve the quality of their product. One example would be newspapers. Bigger cities need not have more newspapers than smaller cities; instead their newspapers will simply be of higher quality. In such a situation, industry concentration can remain high across all cities. An analyst that ignores this other dimension of competition will simply misinterpret the reason for high concentration as a lack of competitive entry rather than as a result of increased expenditures on quality.

In sum, theoretical developments that improve our understanding of how competition works also reveal that when we perform quantitative studies of competition, our statistical methods and our interpretation of the results have to be filtered through these new theoretical insights. We will see that few of the recent advances discussed in the next section really do so.

IV. SOPHISTICATED METHODS OF QUANTITATIVE ANALYSIS

Within the past 10 to 15 years, there have been significant advances in the empirical techniques used to analyze antitrust issues, especially mergers. I discuss two of these techniques. One is merger simulation, which came into general use within the last 15 years. There have been some recent and important insights into its use that relate to "pass through" studies (studies of the rate at which costs are passed through to consumers) which I will describe. The second is "upward price pressure" ("UPP") whose use is relatively new and results from a paper by Farrell & Shapiro,¹⁰ the two chief economists currently at the Federal Trade Commission and the U.S. Department of Justice, respectively. The UPP method is really a quick replacement for a full merger simulation and I will describe some of its limitations. Both merger simulation and UPP techniques, as I will describe in more detail below, take as given the description of the type of competition among firms. As far as I am aware, there is no method in general use that tries to model this important factor.

Both merger simulation and UPP rely on some estimate of the demand curves facing individual firms. There has been an explosion in the sophistication of the empirical techniques

¹⁰Joseph Farrell & Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, 10(1) THE B.E.J. THEORETICAL ECON., Art. 9, (2010).

used to estimate demand systems.¹¹ There are two main statistical techniques. One involves using demand curves that have very flexible forms, yet have enough restrictions so that the parameters can be estimated—the so-called AIDS demand systems.¹² The other approach uses what is called a discrete choice setting in which consumers have preferences not for a particular product but rather for the characteristics describing any product. This method is used when, for example, a consumer is deciding which brand of car to purchase and does so based on the underlying characteristics of the car such as color, horsepower, and the like. Various advances in this method, such as those due to Berry, Levinsohn, & Pakes,¹³ allow for general heterogeneity in the population.

These empirical approaches have allowed more accurate estimation of demand for individual products and have generally improved the analysts' ability to understand how prices of various related products affect demand for one particular product. We will soon see the advantage—or necessity—of having demand curves that do not impose implicit assumptions on the demand system that would predetermine answers to certain antitrust questions.

A. Merger Simulation

Suppose that there are several firms each of which produce a single differentiated product. First, using some appropriate technique, econometrically estimate the demand curve of each of these products as a function of all the prices of these products. Next, **assume** some form of competition among the firms. The usual assumption in merger simulations is static Bertrand. This means that, in competing with each other, firms pay no attention to the future and that firms take the prices of their rivals as given. Using the observed prices, calculate from the optimal pricing conditions—the ones that relate prices to costs and the estimated demand elasticities—the implied values for marginal costs. If firm 1 and firm 2 propose to merge, compute the new post-merger prices by calculating the new prices from the just-calculated marginal costs and from the estimated demand elasticities and cross-elasticities.

The new optimal pricing conditions will reflect that the merged firm, when it is considering raising the price of product 1, will take into account that some of the demand from product 1 that is lost will be diverted to product 2 which it now owns and from which it will earn a profit. Similarly, when the merged firm is setting the price of product 2, it will recognize that some of the demand for product 2 that is lost as a result of a price increase in product 2 will be diverted to product 1 which the merged firm now owns and from which it will earn a profit. The new prices for products 1 and 2 will typically be higher than the pre-merger prices because the merged firm loses less from raising price than did the single pre-merger firms as the merged firm recognizes that the consumers it would have lost pre-merger are recaptured by the merged firm when those consumers buy the merged firm's other product.

The technique of merger simulation is an excellent one for helping the analyst interpret all the elasticities and cross-elasticities of demand that he or she has estimated. But it does have some serious limitations. I will point out some of the most salient ones:

¹¹ For a recent survey, see Liran Einav & Jonathan Levin, *Empirical Industrial Organization: A Progress Report*, 24 J. ECON. PERSPECTIVES 145 (2010).

¹² See Jerry A. Hausman, Gregory K. Leonard & J. Douglas Zona, *Competitive Analysis with Differentiated Products*, 34 ANNALES D'ECONOMIE ET DE STATISTIQUE 159 (1994).

¹³ Steven Berry, James Levinsohn, & Ariel Pakes, *Automobile Prices in Market Equilibrium*, 63 ECONOMETRICA 841 (1995).

1. First, it almost always produces price increases regardless of the number of firms involved. Assumed efficiencies from a merger can offset these predicted price increases—I will have more to say about that in a moment.
2. Second, there is something a bit odd about ignoring cost information from the firms. It is true, as I have described already, that costs can be hard to estimate, especially marginal costs. But a merger simulation technique typically derives the marginal costs solely from the estimated demand system. Surely some cost information could be useful in the estimation procedure.
3. Third, the simulation assumes a static Bertrand competition model, with typically no testing of that assumption. If the firms engage in more dynamic oligopoly behavior in which one firm responds to another firm's pattern of behavior—as in some traditional oligopoly models—then this simulation may produce very incorrect intuition. Even if a static model is appropriate, there is no reason that Bertrand should be the one that best fits an industry. I suspect the Bertrand model is used because it is simple and theoretically appealing.¹⁴
4. Fourth, the models assume typically that the lack of competition is only at the stage of the firms being modeled and that, for example, distribution channels used by the firms are competitive.
5. Fifth, competition is focused on price alone. New entry, extension of product lines, and non-linear pricing are all ignored.
6. Finally, the exact form of the demand curve can have an enormous effect on the predicted post-merger price increases. For example, a logit demand system has built into it a certain pattern of elasticities and cross-elasticities that depends on market shares. That might not be the best demand system to use, especially when it is the pattern of substitution across products that is the focus of interest.

Despite these and other drawbacks, the benefit of a merger simulation is it gives the analyst some way (though not always a good way) to interpret the parameters of the estimated demand system.

There has recently been an increased interest in studying how cost changes get passed through to consumers in a particular industry.¹⁵ The reason this topic is related to a merger simulation is as follows. Suppose that one has estimated a demand system and, as in merger simulation, is willing to focus on price competition and assume static Bertrand behavior. Then once one has estimated the demand system, one can then calculate how prices will change if costs rise by, say, \$1. It turns out that the same demand parameters that are important for this calculation are also important for answering the question of how much prices will rise if two firms merge.

One way to understand the intuition behind the result is to realize that when two firms merge then in pricing each of its products, the firm will regard it as a reduction in “cost” if it

¹⁴ Although not frequently done, it is possible to test the Bertrand assumption by embedding the static Bertrand model in a more general model. See Bresnahan, *supra* note 5.

¹⁵ See Luke M. Froeb, Steven Tschantz & Gregory J. Werden, *Pass-Through Rates and the Price Effects of Mergers*, 23 INT'L J. INDUS. ORGANIZ. 703 (2005) and E. Glen Weyl & Michal Fabinger, *Pass-Through as an Economic Tool*, working paper (October, 2009).

gains sales (more precisely, profits) from other products that the merged firm now owns and to which consumers switch in response to a price increase in one of its products. If a particular demand system has a high pass-through rate, then a merger simulation using that demand system will tend to produce a large price increase. Conversely, the recent literature has shown how it is inconsistent, on the one hand, to argue that a merger will raise price a lot but then, on the other hand, to ignore the downward effect on prices of uncontested merger-specific efficiencies because there is a concern that not much of the efficiencies will be passed through to consumers. This is apparently what might have happened in the recent U.S. case involving Staples.¹⁶

Given the close relation between a pass-through rate and a post-merger price increase, one should be aware in any merger simulation whether the demand system being used is flexible enough to accommodate and thereby estimate any pass-through rate. Many demand systems constrain pass-through rates to be below one. Demand systems (*e.g.*, linear) that have low built-in pass-through rates will produce merger simulation results that predict low post-merger price increases compared to other demand systems with higher built-in pass-through rates. I will give a numerical illustration in the next section.

B. Upward Pricing Pressure

There has been much attention recently in the United States to UPP.¹⁷ The interest has been recently heightened because of the inclusion of the terms “upward pricing pressure” in the proposed U.S. Horizontal Merger Guidelines issued in April 2010.¹⁸ UPP is not a new technique. It instead is being suggested as a screen to use in merger cases that is a short-cut to a full merger simulation.

The logic behind UPP is impeccable. As described earlier, a merged firm that now controls prices of products 1 and 2 will take into account the effect of pricing of product 1 on demand for product 2 and vice versa. Specifically, unlike pre-merger, when the firm is asking whether to raise the price of product 1, the firm will now take account of the fact that it will divert sales to product 2 and earn a margin on each such sale. If D equals the diversion ratio (the fraction of sales that leave product 1 and are diverted to product 2 when the price of product 1 rises by \$1), then the profitability to the merged firm of raising product 1's price rises by D times M , where M is the margin (price minus marginal cost) on product 2. The higher is $D \times M$, the greater is “upward pricing pressure” for the price of product 1 to rise, roughly speaking. Only if there is an offsetting efficiency in product 1 will there not be an indicated incentive to raise price of product 1, according to the UPP index. The UPP index equals $D \times M - E$ where E stands for merger-specific efficiencies in product 1. The UPP index is always positive in the absence of merger-specific efficiencies when products are substitutes.

The notion that D and M are easy to calculate compared to the parameters of a full demand system is a bit illusionary because D depends on a ratio of derivatives that one has to estimate and M is the margin (price minus marginal cost) that we have already discussed can be hard to estimate. It is true that, unlike in merger simulation where one needs the entire demand

¹⁶ Froeb, *et al. Id.*

¹⁷ Farrell & Shapiro, *supra* note 10.

¹⁸ For a discussion of revisions to the U.S. Horizontal Merger Guidelines, see Dennis W. Carlton, *Revising the Horizontal Merger Guidelines*, 6(3) J. COMPETITION L. & ECON 619 (2010).

system, in a UPP analysis one needs to estimate fewer demand curves, but such estimation is still required.

UPP has many of the same disadvantages as merger simulation so I will not repeat those. An additional drawback is that, unlike merger simulation which solves for the new equilibrium post-merger prices, a UPP analysis suggests at most only whether the price of product 1 will rise—not by how much.¹⁹ Although this point is known,²⁰ there is a real danger that it is not well understood especially by courts and foreign antitrust agencies who might logically assume that the higher is the UPP index the higher is the likely price increase.

To understand this point, consider Table 1, which presents two cases in which the UPP index is identical in the premerger equilibrium but for which a merger creates very different price increases, based on merger simulation. For example, in Case A of Table 1, the predicted price increase using a linear demand system is 4.61 percent while in Case B, using a variant of an AIDS demand system, the price increase is almost double at 8.43 percent.²¹ This table also illustrates that the form of the demand curve matters a lot to predictions of post-merger price increases so it is important to use a very flexible demand system to avoid imposing constraints on demand that will implicitly influence the size of the predicted post-merger price increase. This point is well known and is related to the pass-through point that I discussed previously since the pass-through rate depends on the shape of the demand curves.²²

Table 1: UPP and Predicted Price Change from Merger Simulation

Model	UPP Index for Firm 1	Price Increase for Firm 1 from Merger Simulation
Case A: Demand is Linear	\$6.25	4.61%
Case B: Demand is PC AIDS	\$6.25	8.43%

¹⁹ I use “suggest” because a positive UPP index for product 1 indicates that price will rise for product 1 only if the UPP indexes for each of the merged firm’s products are also positive.

²⁰ See, e.g., Farrell & Shapiro, *supra* note 10.

²¹ The details of the example in Table 1 are as follows. In Case A, the demand curve for Firm 1 takes the linear form: $Q_1 = 50 - P_1 + 0.25 * P_2 + 0.25 * P_3 + 0.25 * P_4$, where Q_1 is the quantity produced by Firm 1, and P_1 through P_4 are prices for Firms 1 through 4, respectively. The demand curves for other firms are symmetric to that of Firm 1. For Case B, the PCAIDS demand curve (see Roy J. Epstein & Daniel L. Rubinfeld, *Merger Simulation: A Simplified Approach with New Applications*, 69 ANTITRUST L.J. (2001)) for Firm 1 is given by: $S_1 = 0.25 - 0.75 * \ln(P_1) + 0.25 * \ln(P_2) + 0.25 * \ln(P_3) + 0.25 * \ln(P_4)$, with the demand curves for all other firms symmetric to that of Firm 1. For both Case A and Case B, the marginal cost for each firm is \$75 and competition is assumed to be static Bertrand. Hence, in the pre-merger equilibria for both Case A and Case B, the following conditions hold: each product has a price of \$100, each firm sells a quantity of 25 units, the own-price elasticity for each product is equal to -4, and the cross-price elasticity between all products is equal to 1.

²² See Philip Crouke, Luke M. Froeb, Steven Tschantz, & Gregory J. Werden, *Effects of Assumed Demand Form on Simulated Postmerger Equilibria*, 15 REV. INDUS. ORG. 205 (1999).

Another drawback of UPP is that, unlike merger simulation, UPP is calculated on a product-specific basis and ignores efficiencies in other products. Therefore it will tend to be biased, on that account, to find an adverse competitive effect on price where none exists. The reason is that the efficiency in, say, product 2 will make it profitable for the merged firm to lower the price of product 2 which in turn will make it more profitable for the merged firm to lower the price of product 1 (because of demand substitution between products 1 and 2).

For example, using the same example as in Case B of Table 1, I report in Table 2, for assumed values of efficiency in product 2, a modified UPP index (that uses the post-merger marginal cost of product 2) and the predicted post-merger prices based on a full merger simulation. The table illustrates an example in which the UPP index is positive, suggesting that the post-merger price of product 1 will rise, but, in fact, because of merger-specific efficiencies in product 2, when one does the full merger simulation, the overall price increase in product 1 is not positive. Specifically, with efficiencies in product 2 at 25 percent, the post-merger price of product 1 falls so that the merger is pro-competitive—exactly the opposite of what UPP predicts!

Notice also that as efficiencies in product 2 increase, the modified UPP index gets larger—suggesting more pressure for a price increase—when, in fact, the merger simulations which take into account the post-merger efficiencies in product 2 show exactly the opposite—*i.e.*, the price increase in product 1 falls as the efficiencies in product 2 increase.

Table 2: UPP Index and Efficiency in Product 2

Firm 2 Marginal Cost Efficiency	Firm 1 “Modified UPP Index”	Firm 1 Price Change
0%	\$6.25	1.54%
10%	\$8.13	0.86%
20%	\$10.00	0.00%
25%	\$10.94	-0.51%

UPP might turn out to be a useful screen—and it is easier to do than a full-blown demand estimation and merger simulation—but only time will tell whether that is in fact the case. This leads naturally to my next topic, namely the dearth of research on which empirical techniques in antitrust work best.

V. EVALUATION OF THE PERFORMANCE OF MERGER SIMULATION AND UPP

There has been little research devoted to testing how well merger simulations do in predicting post merger behavior and no study of how the UPP index performs as a screen to identify possibly anticompetitive mergers. The research that has been done presents a mixed record for merger simulation.²³

²³ See Oliver Budzinski & Isabel Ruhmer, *Merger Simulation in Competition Policy: A Survey*, 6 J. COMPETITION L. & ECON. 277 (2010).

Nevo²⁴ estimates a sophisticated demand structure for ready-to-eat cereals and then uses a merger simulation to predict prices from mergers that did occur. He is unable to obtain detailed post-merger pricing data but, based on available data, he concludes that the merger simulation does a good job predicting post-merger price increases. Pinske & Slade²⁵ estimate demand systems and use merger simulation to analyze mergers in the U.K. brewing industry. They find that their model does a good job of predicting the one-year price change following one of the consummated mergers. Their paper is noteworthy because, unlike the typical merger simulation, they use data on costs to test whether the Bertrand assumption (which implies a relation between the demand parameters and marginal costs) is valid and find that it is.

Probably the most interesting and thorough study of merger simulation is that of Peters.²⁶ He examines five airline mergers, estimates demand models, and then applies merger simulation to predict post-merger prices. He has lots of detailed pricing data post-merger that allows him to test the accuracy of the technique. The results are quite mixed with the merger simulation predicting large price increases for some mergers where the actual increases were small and predicting small price increases where the actual increases were large. On average, across the five mergers, the actual price increases were around 16.5 percent while the estimated average price increases from the best merger simulations were around 11 percent. Interestingly, the “old” way of analyzing the relation of price to concentration (even ignoring endogeneity of concentration)—*i.e.*, a regression of price on concentration—produces average estimates of price increases of around 15 percent—being dumb apparently has some benefits.

The most interesting aspect of Peters’ work is that he is able to ask what cost changes post merger would be needed in order to square his results with the actual results. Peters rejects that such cost changes are plausible and concludes that the Bertrand assumption of how airlines compete is likely inaccurate, leading to inaccuracies in merger simulation results. Though he does not explain why this should be so, one possible explanation is that in the airline industry there are lots of interactions over time and across routes—think of how pricing influences the ratio of connecting to direct passengers on a flight segment—and those interactions are not modeled.

Finally, Weinberg & Hosken²⁷ analyze two recent mergers, one involving motor oil and the other involving breakfast syrups. Their findings are that the merger simulation technique does a bad job of identifying which merger to stop. For the merger (motor oil) in which the merger simulation generally indicates a relatively small price increase (under 5 percent), the actual price increase was above 5 percent for a key product, while for the merger (breakfast syrups) where the merger simulations predicted large post-merger price increases (generally above 5 percent) the actual price increases were quite small (2 percent or less).

²⁴ Aviv Nevo, *Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry*, 31 RAND J. ECON. 395 (2000).

²⁵ Joris Pinske & Margaret E. Slade, *Mergers, Brand Competition, and the Price of a Pint*, 48 EUR. ECON. REV. 617 (2004).

²⁶ Craig Peters, *Evaluating the Performance of Merger Simulation: Evidence from the U.S. Airline Industry*, 49 J. L. & ECON. 627 (2006).

²⁷ Matthew C. Weinberg & Daniel Hosken, *Using Mergers to Test a Model of Oligopoly*, paper presented at the First Annual Federal Trade Commission & Northwestern University FTC Microeconomics Conference, November 6-7, 2008, Washington, D.C. (2008).

More research evaluating the success of merger simulation and other techniques is exactly what is needed in order to develop a sense of the best tools to apply to antitrust. In Carlton,²⁸ I urged antitrust agencies from around the world to start keeping track of not only post-merger prices (and, I should add, prices post-litigation in non-merger cases) but equally as important what their various analyses predicted regarding either post-merger or post-litigation behavior after certain practices are stopped. Only by comparing the predicted to the actual will we be able to figure out which techniques are reliable and which ones are not. Without such analyses, we will remain in the dark as to what are the best tools to implement competition policy.

²⁸ Dennis W. Carlton, *Why We Need to Measure the Effect of Merger Policy and How to Do It*, 5(1) COMPETITION POL'Y INT'L 77 (2009).