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*Antitrust Evaluation of Horizontal  
Mergers: An Economic Alternative to  
Market Definition*

**Joseph Farrell**

Professor of Economics  
University of California-Berkeley

**Carl Shapiro**

Transamerica Professor of Business Strategy  
Department of Economics  
University of California-Berkeley

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# **Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition<sup>†</sup>**

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**Joseph Farrell and Carl Shapiro\***

In recent years, the Antitrust Division of the Department of Justice (DOJ) and the Federal Trade Commission (FTC) have reviewed mergers and acquisitions valued at over \$1 trillion annually.<sup>1</sup> And in the past ten years, the DOJ initiated 1697 investigations of mergers under §7 of the Clayton Act, compared with only 75 investigations of monopolization under §2 of the Sherman Act.<sup>2</sup> Merger review looms very large in antitrust analysis.

Since it is highly disruptive to “unscramble the eggs” by separating two firms after they have joined, merger review is almost invariably prospective.<sup>3</sup> Under the 1976 Hart-Scott-Rodino Act, merging parties must generally notify the DOJ and the FTC of a substantial proposed merger.<sup>4</sup> One of the agencies takes responsibility for reviewing it, and the merging parties must supply information demanded by that agency. The merger may not be consummated until the agency has had a statutorily prescribed time in which to review it.<sup>5</sup> For the agency to block a

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\* Farrell is Professor of Economics at the University of California at Berkeley. Shapiro is the Transamerica Professor of Business Strategy and Professor of Economics at U.C. Berkeley. Both authors are former Deputy Assistant Attorneys General for Economics at the US Department of Justice Antitrust Division.

<sup>1</sup> See “Hart-Scott-Rodino Annual Report, Fiscal Year 2006,” <http://www.ftc.gov/bc/hsr/hsrinfopub.shtm>, p. 6. Transactions valued at about \$1.3 trillion were reported in Fiscal 2006, and about \$1.1 trillion in Fiscal 2005. In Fiscal 2000, during the dot-com boom and before the size-of-transaction threshold was raised from \$15 million to \$50 million, transactions valued at more than \$3 trillion were reported. In Fiscal 2006, there were 210 transactions each valued at more than \$1 billion (Ibid., Exhibit A, Table I).

<sup>2</sup> “Antitrust Division Workload Statistics FY 1998-2007,” <http://www.usdoj.gov/atr/public/workstats.htm>.

<sup>3</sup> The antitrust agencies occasionally prosecute anticompetitive mergers *ex post* (for example the FTC’s case against Evanston Northern Hospital :see e.g. Botti 2008), but the vast bulk of merger review is prospective. Many other antitrust jurisdictions have similar provisions (see e.g. Motta 2004), although the UK has only voluntary pre-notification.

<sup>4</sup> The “size of transaction” threshold was set at \$50 million in 2000 and indexed to GNP; it is \$63 million in 2008.

<sup>5</sup> This time period culminates with thirty days following “substantial compliance” with the agency’s “second request” for information from the merging parties. Modified procedures apply to hostile takeovers. In addition to

merger, it must convince a Federal judge that, in the language of Section 7 of the Clayton Act, the merger's effect "may be substantially to lessen competition, or to tend to create a monopoly."<sup>6</sup>

Antitrust evaluation of a proposed merger thus involves predicting the economic effects of a structural change in an oligopoly. Since every merger has idiosyncratic aspects and takes place in an evolving market environment, it is notoriously difficult for the antitrust agencies to establish before a court the mechanism by which a merger assuredly will cause anti-competitive effects. As a result, effective pre-merger control must afford the antitrust agencies with some means of establishing a *presumption* that a proposed merger will harm competition. Once this presumption is established, the burden shifts to the merging parties to show that their proposed merger will *not* harm competition.

The need for an informative yet simple and speedy indicator of the likely effects of a proposed merger has long been recognized. The established approach uses market concentration: proposed mergers that substantially increase concentration in a "relevant antitrust market" are presumed to be anti-competitive. However, as discussed immediately below, that approach can be needlessly roundabout and inaccurate in industries with differentiated products.

In this paper, we put forward an alternative approach to establishing a presumption of anti-competitive effects. Our approach, based directly on the underlying economics of price competition, asks whether the proposed merger will generate upward pricing pressure (UPP). This involves comparing the strength of two opposing forces: the loss of direct competition between the merging parties, which creates upward pricing pressure, and cost savings from the merger, which create (offsetting) downward pricing pressure. Under our test, if the net effect of these two forces is upward pricing pressure, the merger is presumed to be anti-competitive. We show how these forces are most naturally compared *without* working out the full equilibrium adjustment of the industry.

While our approach is meant as an alternative to the entrenched method based on market definition and concentration, it has much in common with that method:

(1) Each approach involves a simple test designed to establish a rebuttable presumption, recognizing the difficulty of fully analyzing and proving effects;

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information from the merging parties, the antitrust agencies can subpoena information from others (a "civil investigative demand") to help in evaluating a merger.

<sup>6</sup> The Clayton Act (15 U.S.C. 18) was passed in 1914 and amended in 1950. The procedure is somewhat different for the FTC versus for the DOJ. Throughout the process, bargaining takes place in the shadow of the statute, and many more mergers are abandoned "voluntarily" by the parties, or modified with a negotiated "settlement" designed to preserve competition, than are actually adjudicated by courts. In Fiscal 2006, 1768 transactions were reported to the agencies, who issued a "second request" demanding additional information in 45 of these cases. The agencies challenged 32, leading to 17 settlements with the merging parties (consent decrees), 6 restructured transactions, and 9 abandoned transactions. The DOJ has not litigated a merger case in nearly four years, during which time the FTC has litigated roughly one merger case per year.

(2) Each approach involves a simple test that reflects a core economic idea. Conceptually, the market concentration approach is inspired by the fact that higher share lowers a firm's marginal revenue in a Cournot model of oligopoly with homogeneous products, while our approach is derived from a Bertrand model of oligopoly with differentiated products;

(3) The strength of the presumption established by the test can be adjusted—in the case of concentration measures, by choosing thresholds at which concentration evokes various degrees of concern and suspicion; in our case, by choosing how much credit to give for presumed efficiencies;

(4) Neither approach attempts to capture the full complexity of effects or to quantify the likely equilibrium effects (e.g., price change) of the merger; and

(5) Under either approach, subsequent “back-end” analysis can look much more fully at effects, and even try to quantify them, quite possibly reversing a presumption.

## 1. Problems with the Presumption Based on Concentration

For roughly the past half century, the cornerstone of merger control policy has been the presumption that a merger which substantially increases market concentration is likely to be anti-competitive. The Supreme Court established this presumption in the landmark 1963 *Philadelphia National Bank* case, where it stated:<sup>7</sup>

This intense congressional concern with the trend toward concentration warrants dispensing, in certain cases, with elaborate proof of market structure, market behavior, or probable anticompetitive effects. Specifically, we think that a merger which produces a firm controlling an undue percentage share of the relevant market, and results in a significant increase in the concentration of firms in that market, is so inherently likely to lessen competition substantially that it must be enjoined in the absence of evidence clearly showing that the merger is not likely to have such anticompetitive effects.

This “structural presumption” was based on the structure-conduct-performance paradigm that then dominated industrial organization economics, under which increases in market concentration were linked to declines in market performance. In recent decades, however, as reflected by the rise of the Chicago School in law and economics, both industrial organization scholars and the courts have been more apt to stress that high concentration need not be incompatible with vigorous competition and efficient market performance. Thus, while *Philadelphia National Bank* has never been overruled, the presumption that it creates has been greatly weakened, especially over the past 25 years.<sup>8</sup>

Meanwhile, internal merger review at the DOJ and the FTC has become far more sophisticated. The agencies do not mechanically rely on the market shares of the merging firms to evaluate

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<sup>7</sup> United States v. Philadelphia National Bank, 374 U.S. 321, 363 (1963).

<sup>8</sup> On the decline of the structural presumption, see Jonathan Baker and Carl Shapiro, “Reinvigorating Horizontal Merger Enforcement,” available at <http://faculty.haas.berkeley.edu/shapiro/mergerpolicy.pdf>.

mergers. Instead, they attempt to understand the economics of the industry, and are likely to try to block a merger only if they can specifically identify a mechanism by which the proposed merger will cause anti-competitive effects. As explained in their Horizontal Merger Guidelines (“Guidelines”), the agencies consider two basic theories of anti-competitive effects.<sup>9</sup> “Coordinated effects” arise if the merger would increase the likelihood of (perhaps tacit) collusion with other firms. “Unilateral effects” arise if the merger would give the merged entity a unilateral incentive to change its behavior (usually by raising prices) in a way that harms consumers. However, the Guidelines must be consistent with the controlling case law, and they still cling to the basic structural framework. Thus the Guidelines begin by defining the relevant market and measuring market concentration, and they emphasize concentration as an indicator of competitive effects.

Unfortunately, this approach can break down in the very important class of mergers in which the merging firms sell differentiated products and the merger may lead to unilateral effects. Examples of such mergers abound, including most if not all mergers involving retailing, branded consumer products, computer hardware and software, information content (magazines, newspapers, music, video programming), consumer durables, and consumer electronics. In these industries, defining the relevant market can be problematic, and the link between market shares and competitive effects can be greatly attenuated.

Some of the difficulties that arise when the agencies attempt to invoke the structural presumption are illustrated by the merger proposed in 2007 between Whole Foods and Wild Oats, two chains of grocery stores specializing in natural and organic food. Whole Foods planned to close a number of Wild Oats stores that were near existing Whole Foods stores. Whole Foods’ founder and CEO, John Mackey, told his Board of Directors: “[b]y buying [Wild Oats] we will \*\*\* avoid nasty price wars in Portland (both Oregon and Maine), Boulder, Nashville, and several other cities which will harm our gross margins and profitability.”<sup>10</sup> Mr. Mackey also stated: “One of the motivations is to eliminate a competitor. \*\*\* That is one of the reasons we are willing to pay \$18.50 [per share] for a company that has lost \$60 million in the last six years. If we can’t eliminate those stores, then Wild Oats, frankly, isn’t worth buying.”<sup>11</sup>

Seeking to block the merger, the FTC tried to assert the structural presumption, requiring it to establish “the relevant market.” As the Court of Appeals later noted, there was strong evidence that Whole Foods and Wild Oats were especially close competitors among supermarkets. “Whole Foods’s internal projections, based on market experience, suggested that if a Wild Oats near a Whole Foods were to close, the majority (in some cases nearly all) of its customers would switch to the Whole Foods rather than to conventional supermarkets.”<sup>12</sup> Seeking to express this

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<sup>9</sup> The Guidelines are available at <http://www.usdoj.gov/atr/public/premerger.htm>.

<sup>10</sup> Proof Brief for Appellate Federal Trade Commission, *Federal Trade Commission v. Whole Foods Market and Wild Oats Market*, Court of Appeals for the District of Columbia Circuit, p.11.

<sup>11</sup> *Ibid.* p. 12.

<sup>12</sup> *Federal Trade Commission v. Whole Foods Mkt. Inc.*, Court of Appeals for the D.C. Circuit, Case. 07-5276, Decided July 29, 2008, at p. 18.

closeness in the language of market definition, the FTC argued that Whole Foods and Wild Oats competed in a market for “premium natural/organic supermarkets.”

Intuitively, this might seem an audacious, even gerrymandered, “market definition.” Surely Whole Foods’ customers can buy groceries—even many organic foods—at Safeway too. Whole Foods surely faces some competition from such “traditional supermarkets;” indeed, there was evidence that patrons of Whole Foods and Wild Oats also “cross shop” at traditional supermarkets. And courts have held that, as the *Whole Foods* court stated (p. 13): “A market ‘must include all products reasonably interchangeable by consumers for the same purposes.’” *Microsoft*, 253 F.3d at 52.” Thus the Court ruled that “...the FTC has not met its burden to prove that ‘premium natural and organic supermarkets’ is the relevant product market in this case for antitrust purposes.”<sup>13</sup>

And that was the ballgame. The Court stated (at 5):

[If] the relevant product market is, as the FTC alleges, a product market of “premium natural and organic supermarkets” consisting only of the two defendants and two other non-national firms, there can be little doubt that the acquisition of the second largest firm in the market by the largest firm in the market will tend to harm competition in that market. If, on the other hand, the defendants are merely differentiated firms operating within the larger relevant product market of “supermarkets,” the proposed merger will not tend to harm competition.

From an economic point of view, it seems strange to rely so heavily on the line-drawing exercise of deeming some differentiated products “in” the market while others are “out.”<sup>14</sup> Whether or not the merger between Whole Foods and Wild Oats was anticompetitive, the market definition inquiry addressed that question at best indirectly. It could only clumsily ask how strongly Whole Foods and Wild Oats were differentiated from traditional supermarkets. To this key question, it was open to only two answers: either they are so strongly differentiated that they are (almost) their own separate market, making it a merger (almost) to monopoly, or they are so weakly differentiated that one should treat them as two rather small players among all supermarkets.<sup>15</sup> Neither answer seems a good way of expressing substantial-but-not-overwhelming product differentiation. Neither fits well with the economic way of thinking.

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<sup>13</sup> Federal Trade Commission v. Whole Foods Mkt., Inc., 502 F. Supp. 2d 1 (D.D.C. 2007), p. 36. The FTC appealed and won a remand.

<sup>14</sup> Jonathan Baker (2007) argues that: “Throughout the history of U.S. antitrust litigation, the outcome of more cases has surely turned on market definition than on any other substantive issue.” While much has been written in antitrust economics on how best to define markets, the fact is that in many differentiated-product industries, there is no clearly right way to draw the inevitably somewhat arbitrary boundaries.

<sup>15</sup> An additional, and important, layer here is that two different concepts of market definition are at interplay. The “all products reasonably interchangeable” approach, and the idea that “the relevant market” should include all substantial competitors—for instance, all those whose prices the merging firms track—tends to lead to relatively broad markets. The Guidelines, however, put forward a market definition algorithm (the “hypothetical monopolist test”) that often leads to perhaps surprisingly narrow markets. In *Whole Foods*, economic experts came to differing conclusions about Guidelines-based market definition, but we find it difficult not to think that the District court’s ruling against the FTC’s expert’s narrower conclusion on this question was based in part on ideas imported from the other interpretation.

Relying on measures of market concentration focuses the debate on a line drawing exercise – which products are “in” or “out” of the market – and away from a more direct evaluation of the merger’s effects. If the market is defined narrowly, the agencies are subject to criticism for “ignoring” products that do compete against the products of the merging firms. If the market is defined broadly, the market shares of the merging firms may greatly understate the extent of lost competition if their products are close to each other in that broader market. That was clearly the case in the Whole Foods/Wild Oats merger if viewed in a market including all supermarkets.<sup>16</sup>

This problem is endemic to industries with differentiated products. When Amazon.com teamed up with Borders on-line, was the relevant market on-line book retailing or all book retailing? When Miller acquired Coors, was the relevant market domestic beer, beer, all alcoholic beverages, or all beverages? When XM and Sirius merged, was it a merger to monopoly in a market for satellite radio or a minor event in a broader market including terrestrial radio?

Worse yet, in some cases, the antitrust agencies have been unable to block a merger due to their inability to establish the precise boundaries of the relevant market. For example, the DOJ sued to stop Oracle from acquiring PeopleSoft. The DOJ showed that Oracle and PeopleSoft were important, direct competitors in relevant markets for high-function human relations management (HRM) and financial management systems (FMS) software. In that market, their proposed merger would have reduced the number of major competitors from three to two, with SAP being the chief rival to the merged entity. While Oracle and PeopleSoft competed head-to-head in selling HRM and FMS software, the court observed some competition from other suppliers and ruled that the DOJ had failed to establish its proposed relevant product market and could not invoke the structural presumption. Despite testimony from sophisticated customers that they would be harmed by the loss of competition, the merger was permitted to go forward.

Rather than basing a presumption of anti-competitive effects on market definition and market concentration, for cases involving differentiated products we propose a much simpler and more direct method. Our proposed approach, described immediately below, relies on some very basic and general principles from price theory. Our approach is similar to the one that has been used in recent years in UK competition policy.<sup>17</sup>

## **2. Pricing Pressure Effects of a Merger**

Merger investigation usually begins by considering the merger’s effects on pricing incentives, holding fixed the set of firms (except for the change due mechanically to the merger) and of their products. The focus on prices is partly a matter of convenience, partly reflects a view that incentives to raise prices would be echoed in incentives to compete less hard in other ways, and

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<sup>16</sup> One approach to expressing this within market-definition language uses the concept of “submarkets”. Perhaps because it can be abused through vagueness, this idea has fallen out of favor, but the Court of Appeals in Whole Foods seemed to revive it.

<sup>17</sup> See, for example, the U.K. Competition Commission (2005).

partly reflects the fact that U.S. antitrust law generally evaluates mergers based on their impact on consumers.<sup>18</sup>

When rival firms merge, there are two direct and immediate effects on pricing incentives. First, the merging firms no longer compete with each other to attract customers. This generically encourages them to raise prices.<sup>19</sup> Second, the firms' assets can now be managed jointly to achieve efficiencies. This can lead to lower costs, encouraging lower prices. The analysis of unilateral effects involves comparing these two effects.<sup>20</sup> We now describe a simple and transparent way to quantify the loss of direct competition in terms that can be directly compared against estimates of marginal-cost efficiencies. While we derive our test formula in a very simple setting, the economic idea underlying our test formula is robust.

### *A. Quantifying the Cannibalization Effect*

Consider a proposed merger between two rival single-product firms, A and B, who are Bertrand competitors with differentiated products. The firms' profits are denoted by  $\pi_A$  and  $\pi_B$ . Firm A sells Product 1 at pre-merger price  $\bar{P}_1$ , and Firm B sells Product 2 at pre-merger price  $\bar{P}_2$ , where we use bars to denote pre-merger values of all variables. The firms' pre-merger marginal costs are denoted by  $\bar{C}_1$  and  $\bar{C}_2$  respectively.

When the two firms merge, corporate headquarters wants their prices set to maximize joint profits earned on both products. For simplicity, suppose for a moment that the merger involves no integration of operations and no efficiencies. What instructions should the corporate headquarters send to the managers now running Division A, which sells Product 1, and Division B, which sells Product 2?

Headquarters realizes that Firms A and B have been competing against each other, which now means that the two Divisions, if not controlled in some fashion, will steal business from each other, unhelpfully from the perspective of overall corporate profits; Bertrand equilibrium prices do not maximize joint profits. One natural way for headquarters to control this business stealing is to impose a per-unit internal tax that internalizes the externalities imposed by one division when it captures business from the other by lowering its price. How large should that tax be?

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<sup>18</sup> The agencies' 2006 "Commentary on the Merger Guidelines" summarized: "Following their mandate under the antitrust statutory and case law, the Agencies focus their horizontal merger analysis on whether the transactions under review are likely to create or enhance market power." <http://www.usdoj.gov/atr/public/guidelines/215247.htm>.

<sup>19</sup> There are models, and perhaps real oligopolies, in which some horizontal mergers lead to *no* loss of competition. For example, consider a Cournot industry in which all firms produce at low marginal cost up to capacity. Provided a merger does not concentrate capacity too much, production up to capacity will continue (at least in the short run). But in a differentiated-product framework, any horizontal merger typically encourages some price increase if there are no efficiencies.

<sup>20</sup> The Clayton Act refers to a "substantial" reduction in competition, echoed by European merger law which refers to a "significant" loss of competition. Thus some would argue that horizontal mergers that only slightly reduce competition are not illegal even if there are no efficiencies at all. We interpret "substantial" to mean "exceeding likely marginal-cost efficiencies," as we explain in more detail below.

As a first cut, i.e., evaluating all variables at their pre-merger levels, the tax imposed on Product 1 should be set equal to  $\bar{t}_1 \equiv \left| \frac{d\pi_B}{dX_1} \right|$ , which can be written as  $\bar{t}_1 \equiv \frac{d\pi_B}{dX_2} \left| \frac{dX_2}{dX_1} \right|$ . The term  $\frac{d\pi_B}{dX_2}$  is the increase in the profits from Product 2 if sales of Product 2 rise by one unit, holding fixed the price of Product 2. This equals the margin on Product 2,  $\bar{P}_2 - \bar{C}_2$ . The term  $\left| \frac{dX_2}{dX_1} \right|$  measures the impact on sales of Product 2 when the price of Product 1 is lowered to sell one more unit of Product 1. This is the diversion ratio from Product 1 to Product 2, measured at pre-merger prices, which we denote by  $D_{12}$ . Therefore, the tax imposed on Product 1 should be set equal to

$$\bar{t}_1 = D_{12}(\bar{P}_2 - \bar{C}_2).$$

This tax rate internalizes the cannibalization of sales, and thus profits, at Division B—equivalently, the newly internalized opportunity cost—when Division A sells an extra unit of Product 1, at pre-merger price and cost levels.

The motive force behind the unilateral effects of the merger can thus be thought of as an initial increase of  $\bar{t}_1$  in the marginal cost of Product 1 (along with an analogous cost increase for Product 2). Simple price theory tells us that such a cost increase will lead to an increase in the price of Product 1. Hence the loss of competition between Firms A and B will cause upward pricing pressure for Product 1. Exactly the same analysis applies to Product 2.

### ***B. Merger Efficiencies***

By permitting combinations of factors that it would be hard to bring together across organizational boundaries, a merger can lead to cost savings. If it reduces marginal cost, this factor mitigates and can reverse the UPP resulting from the cannibalization effects just discussed. We now show how to integrate cost savings into the pricing pressure analysis.

Focusing again on Product 1, one can ask whether the proposed merger will lead to a reduction in the marginal cost of Product 1, and if so by how much. In principle one could use whatever information is available to quantify marginal-cost efficiencies from a proposed merger. In practice, merger-specific efficiencies are typically very hard to predict, even for the firms themselves but especially for antitrust agencies and courts. Since we are seeking a simple method by which a presumption can be established, any detailed evaluation of merger efficiencies is postponed until the merging firms seek to rebut the presumption (and is avoided entirely if no presumption is established).. In this respect our approach mirrors current practice.

One approach credits any proposed merger with some default level of marginal-cost efficiencies for each overlap product.<sup>21</sup> It seems sensible to take this default level to be a fraction  $e$  of each product's pre-merger marginal cost. The assumed efficiencies for Product 1 are thus  $e\bar{C}_1$ .

Following Warren-Boulton (1985), we call this the "standard deduction," capturing the idea that merging parties need not prove this level of efficiencies ("itemize") to be credited with them.

The standard deduction could be set based on evidence of the efficiencies that commonly result from horizontal mergers. While establishing the level of  $e$  would involve some challenges, at least this key parameter could be based on directly relevant empirical evidence.<sup>22</sup> Below, we discuss how the level of  $e$  could be determined; in our examples below, for illustrative purposes only, we take  $e = 10\%$ .

### *C. Net Pricing Pressure*

Our test asks whether or not the merger causes upward pricing pressure.<sup>23</sup> We say that the merger will create UPP for Product 1 if the opportunity cost term reflecting cannibalization (at pre-merger prices and costs) exceeds marginal-cost efficiencies (proxied by the standard deduction).

If the merger creates UPP for Product 1, basic economic theory unambiguously predicts that the price of Product 1 will rise. Given a demand curve for a product, the inference that an increase in marginal cost leads a profit-maximizing firm to set a higher price is extremely general, as shown by Samuelson (1943). And it seems plausible that even a firm that does not maximize profits will typically raise its price in response to an increase in marginal cost. Thus UPP leads

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<sup>21</sup> Some observers see this approach, not necessarily explicitly stated, behind the established policy of allowing many horizontal mergers. Tolerance for some horizontal mergers without special showings of efficiencies may thus signal a policy judgment akin to the standard-deduction approach in the text.

<sup>22</sup> If mergers are motivated by increases in profit (rather than empire building, to boost the compensation of top executives, or to exploit imperfect information to increase the merging firm's combined market capitalization without increasing the present discounted value of profits), and if there is little or no anticompetitive effect, one can infer that there must be another profit motive, such as cost savings (though not necessarily in marginal costs). Janusz Ordoover and Robert Willig (1993) state that "the potential magnitude of [unilateral] effects is likely to be small if the combined share of the parties is not substantial [ $<35\%$ ], so that the transaction is likely driven by its creation of efficiencies rather than by market power." See also Willig (1991). To explore such a sliding scale of efficiencies, suppose that one credits the merger with reducing the marginal cost of Product 1 by an expected amount  $e(\bar{t}_1)$  that is a decreasing function of  $\bar{t}_1$ . This rule credits a merger with smaller efficiencies if it would otherwise create more upward pricing pressure. A merger will create upward pricing pressure if and only if  $\bar{t}_1 > e(\bar{t}_1)$ . This reasoning suggests this more complex procedure may be unnecessary: calling  $\bar{T}_1$  the solution to  $\bar{t}_1 = e(\bar{t}_1)$ , the procedure is equivalent to simply crediting all mergers with efficiencies  $\bar{T}_1$ . By setting  $e$  appropriately, one can even credit mergers with more efficiencies if the merging parties are relatively distant competitors.

<sup>23</sup> O'Brien and Salop (2000) discuss "pricing pressure" in the context of collaborative arrangements between competitors that fall short of a full merger.

to an upward shift in the pricing reaction function for Product 1. In a very general class of oligopoly games, this in turn will lead to higher prices.

In the simple case of a merger between two single-product, price-setting firms that we have been developing, the proposed merger creates upward pricing pressure for Product 1 if

$$D_{12}(\bar{P}_2 - \bar{C}_2) > e\bar{C}_1. \quad (1)$$

Inequality (1) is our proposed test: if this inequality is satisfied, there is an initial presumption that the merger will lead to higher prices for Product 1.

In the symmetric case where Products 1 and 2 have the same prices and costs and the diversion ratios are equal in both directions, inequality (1) becomes

$$D > e\left(\frac{1-m}{m}\right) \quad (2)$$

where  $m \equiv (P - C) / P$  is the relative gross margin on each product (as a fraction of its price).

By assuming that any proposed merger will generate some standard level of efficiencies, our test only flags mergers that “significantly” harm competition in the sense that, net of the efficiencies deemed plausible by default, they will create UPP.

At this point we are not attempting to calculate the *magnitude* of the price increase for Product 1. That will depend in a much more complicated way on the demand system for Products 1 and 2 and other competing (and/or complementary) products. Under our approach, such calculations, including merger simulation, are part of the back-end analysis conducted if an initial presumption of UPP is found.

### ***D. Upward Pricing Pressure Leads to Higher Prices***

Our test, as captured for Product 1 in inequality (1), has the enormous practical virtue that it relies only on pre-merger data on prices and costs, along with the key feature of demand that is inherently central to unilateral effects: the diversion ratio,  $D_{12}$ . (Models of price-setting unilateral effects in which market shares matter typically reach this result by assuming that diversion ratios mirror shares.) We achieve this simplicity by asking only about UPP, not about the magnitude of the price increase from the pre-merger to the post-merger equilibrium. Indeed, we have said nothing so far about the post-merger equilibrium price. Our focus on UPP is justified by:

**Proposition 1:** If there is upward pricing pressure for both products, then a merger that generates the default level of efficiencies will lead to higher prices for both products.

**Proof:** Since there is UPP for Product 1, we have  $D_{12}(\bar{P}_2 - \bar{C}_2) > e\bar{C}_1$ , which can be written as  $D_{12} \frac{\bar{P}_2 - \bar{C}_2}{\bar{P}_2} \frac{\bar{P}_1}{\bar{P}_1} \frac{\bar{P}_1}{\bar{C}_1} > e$ . Define the pre-merger relative gross margin of Product

1 as  $m_1 = (\bar{P}_1 - \bar{C}_1) / \bar{P}_1$  and likewise for Product 2. Note that  $\frac{\bar{P}_1}{\bar{C}_1} = \frac{1}{1 - m_1}$ . So the UPP

condition can be written as  $\frac{D_{12}m_2(\bar{P}_2 / \bar{P}_2)}{1 - m_1} > e$ . Werden (1996) provides a formula for the

critical cost reductions necessary for Products 1 and 2 such that the post-merger equilibrium prices are *equal* to the pre-merger equilibrium prices; see his equation (5), p. 411. In our notation, the critical cost reduction necessary for Product 1, as a fraction of

$\bar{C}_1$ , is given by  $\frac{m_2 D_{12}(\bar{P}_2 / \bar{P}_1) + m_1 D_{12} D_{21}}{(1 - m_1)(1 - D_{12} D_{21})}$ . This expression is strictly greater than

$\frac{D_{12}m_2(\bar{P}_2 / \bar{P}_2)}{1 - m_1}$ , so long as both diversion ratios and margins are strictly positive.

Therefore, the cost reductions for Product 1 and Product 2 that would lead to unchanged prices are strictly greater than the default cost reductions that are assumed for the merger. Under our standing assumption that higher costs lead to higher prices, it follows that the merger raises the prices of both products.

Proposition 1 provides a formal theoretical justification for our test, somewhat as results about Cournot equilibrium or symmetric differentiated competition formally justify a focus on concentration and shares. But our test has power because it captures the more general idea that the loss of competition between the merging firms is significant enough to outweigh the efficiencies presumed to result from the merger—somewhat as share-based tests have power because they capture the general idea that high share lowers marginal revenue and encourages price increases in that way.

### ***E. A More Accurate, But More Complex, Test***

Proposition 1 establishes that equilibrium prices will rise if there is UPP for both products. But these sufficient conditions are not necessary. Put differently, our test is one-sided: if inequality (1) is satisfied for both products, a merger with default efficiencies will raise the price of both products, but the converse does not hold. Inequality (1) might fail for one or even both products, yet a merger with default efficiencies could still raise prices. Such false negative test results can occur because the full cannibalization effects are augmented by three forces not reflected in inequality (1). First, if the merger lowers the marginal cost of Product 2, it will raise the margin on Product 2 and thus raise the cannibalization term for Product 1. Second, if the price of Product 2 rises (as it will if there is UPP on both products), that will further raise the margin on Product 2 and further elevate the cannibalization term for Product 1. Third, these effects operating on Products 1 and 2 reinforce each other, as one can see in the proof of Proposition 1.

One could reduce the incidence of these false negative test results by using a more sophisticated version of inequality (1), based on Werden (1996). Werden provides a method for taking this feedback into account, which leads to a more accurate test for upward pricing pressure.<sup>24</sup> In the

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<sup>24</sup> In particular, one could compare Werden's equation (5) on p. 411 with the default efficiency level  $e$ .

simplest case of a merger between two single-product firms, these calculations involve solving a system of two equations. These calculations do not require any more information than our simple condition. While these calculations need not intimidate professional economists, it is not clear to us that they will be readily accepted by generalist judges, who have to wrestle with the possibility of biased or incompetent testimony when faced with analysis that they have difficulty in understanding.<sup>25</sup> We believe that it should be possible to explain to an attentive judge the basic economic logic of viewing  $D_{12}(\bar{P}_2 - \bar{C}_2) - e\bar{C}_1$  as a measure of upward pricing pressure absent marginal-cost efficiencies. However, attempts to calculate and explain full equilibration may quickly lose transparency.

In the symmetric case, the Werden formula is not appreciably more complex than inequality (1). In that case, our test result is positive if  $D > e\left(\frac{1-m}{m}\right)$ . The more sophisticated calculation shows that prices will rise if and only if  $\frac{D}{1-D} > e\frac{1-m}{m}$ , a condition that is clearly easier to satisfy. The correction factor  $1/(1-D)$  is most important where  $D$  is relatively high.<sup>26</sup> For example, with  $m = 1/3$ , i.e., 33% margins, and an assumed 10% cost savings, i.e.,  $e = 0.1$ , our simple condition is satisfied if the diversion ratio exceeds 20%, whereas the more complex and more accurate condition is satisfied if the diversion ratio exceeds 16.7%.

## ***F. Measurement Issues***

Our test requires that one measure three variables: pre-merger prices, pre-merger marginal costs, and the diversion ratios between the two products. Prices and costs are used together to measure gross margins.

All of these variables are already routinely measured in merger analysis, since they are needed for so-called Critical Loss analysis, a leading quantitative technique of market definition.<sup>27</sup>

### **1. Measuring Gross Margins**

Gross margins are also of interest in at least two other contexts, offering some insight into measurement issues.

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<sup>25</sup> Indeed, at the FTC's Unilateral Effects Workshop in February 2008, our much simpler formula, inequality (1), was mocked as overly complex for litigation purposes by a highly regarded litigator with merger experience. We hope and believe that judges are capable of using inequality (1); it seems no more complex to us than the HHI calculations commonly used to measure market concentration.

<sup>26</sup> This symmetric case is equivalent to Werden's (1996) equation (6) (our notation differs somewhat from his). As the text notes, ignoring the feedback effect will lead one most astray where  $D$  is relatively high. In particular, if the two products are very close competitors pre-merger, and there is no third product that is a close substitute, then pre-merger margins may be held to very low levels so that even taking  $D \approx 1$ , estimating upward pricing pressure by  $D$  times gross margin would be a severe underestimate. One approach is to invoke the more sophisticated calculations only when they lead to a different test result, i.e., if the simpler test gives a negative test result, but just barely.

<sup>27</sup> See recently Farrell and Shapiro (2008) and the references therein.

In predatory pricing litigation, Areeda and Turner famously argued that marginal cost may be hard to observe, and indeed even the sign of gross margins is often disputed. But in predatory pricing litigation, almost by definition (under current rules), cost is relatively near price and small differences between “just above” and “just below” matter a lot. In many mergers, gross margins are fairly high, and the test result may not be especially sensitive to the measurement of marginal cost. To illustrate, consider the symmetric case in which the price is \$100 per unit, the marginal cost is estimated at \$60 per unit, so the margin is  $M = 0.4$ . Suppose that mergers are routinely credited with a 10% reduction in marginal cost, so  $e = 0.1$ . Applying inequality (2), the merger creates upward pricing pressure if and only if  $D > 0.15$ . If marginal cost is estimated instead at only \$50 per unit, then  $M = 0.5$  and the test becomes  $D > 0.10$ .

A large empirical industrial organization literature treats gross margins (typically at a relatively aggregated level such as the industry) as a key dependent variable. Many other contributions argue, in contrast, that gross margins are hard to measure in academic cross-sectional studies. But this says little about our ability to measure them for individual firms or products, given subpoena access to firms’ internal accounting and non-public data.

In particular, firms have an incentive to know how far they can profitably cut prices, perhaps on a selective basis, and in other ways to keep track of their cost functions via “decision accounting” or “managerial accounting” tools. Such information is seldom available (certainly not on a systematic basis suitable for cross-sectional study) to academic researchers, but is typically available to the antitrust agencies and the courts.

More difficult measurement issues arise if additional sales generate intangible benefits (or costs) as well as direct and readily quantifiable net receipts. Often, Firm B gains additional value from additional sales of Product 2 beyond the concrete short-term absolute gross margin,  $P_2 - C_2$ .

Conceptually, such future benefits can be treated as adding to the gross margin on Product 2. In some cases, as with subsequent sales of spare parts, these additional margins may be quite concrete. In other cases, they are less tangible. For example, in markets with network effects, learning by doing, or customer switching costs, selling more units today is likely to generate additional benefits in the future. Such follow-on benefits can sometimes be estimated using documents created in the normal course of business by the merging firms. For example, the firms may well have methods of valuing their installed base of customers, either to justify the goodwill on their balance sheets or to evaluate the cost or profitability of customer acquisition.<sup>28</sup> Even if these benefits cannot be measured, we may at least know their sign (typically positive: firms usually like to make more sales), treat the “hard” profit accounting as a bound, and keep track of the direction of error.<sup>29</sup> In most cases, we expect that accounting for these effects will

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<sup>28</sup> American Airlines, for example, invested in a sophisticated management accounting system, AAIMSPAN, to quantify “upstream” and “downstream” follow-on profits reflecting the fact that serving a route from B to C (or increasing the frequency of service on that route) will boost sales on routes A-to-B and C-to-D. This accounting played an important role when the Justice Department unsuccessfully sued American for exclusion of entrants at DFW, and was described in public documents in the case. See Edlin and Farrell (2002).

<sup>29</sup> This issue also arises when measuring gross margins in Critical Loss analysis; see Farrell and Shapiro (2008).

raise the margin on Product 2, making UPP more likely. If these effects are significant, it may be important for the government to account for this in its measurement of gross margins.

## 2. Measuring Diversion Ratios

The diversion ratio could be estimated using econometric methods, or (perhaps more often) based on evidence generated in the normal course of business. Firms often track diversion ratios in the normal course of business to see who they are losing business to, or who they can win business from, perhaps with selectively targeted discounts or marketing. This can be critical for pricing and product repositioning decisions. Survey data can also illuminate diversion ratios,<sup>30</sup> as can information about customer switching patterns.

If Firm A sets different prices for different groups of customers, and if arbitrage between groups does not constrain Firm A's pricing, then the diversion ratio (and margin) can be estimated separately for each customer group. One can thus determine whether the merger will cause upward pricing pressure for one or more of these groups. This procedure can flexibly match the contours of the price discrimination observed in the real world: groups may be defined by whatever customer attributes form the basis of discrimination, such as prior purchase history or location. However, a more complex analysis is required if Firm A engages in other forms of price discrimination such as quantity discounts or special discounts for new customers.

In bidding markets, unilateral anti-competitive effects arise if the merged entity would bid less aggressively than Firms A and B.<sup>31</sup> Essentially, the "number of units sold" by a given supplier is replaced by the "probability of winning the bidding" for that supplier. With this transformation, the diversion ratio from Product 2 to Product 1 is the probability that Firm B is the buyer's second choice when Firm A wins.<sup>32</sup> Bidding markets are thus well suited to our screen, since one often has data on how the buyer ranked the bidders in recent bidding events.

## 3. Sensitivity Analysis

For clarity we have presented our diagnostic test in terms of point estimates (or presumption) for the gross margin, the diversion ratio, and the efficiencies. But because the test's logic is explicit, one can use sensitivity analysis intelligently. For example, suppose that documents indicate that the relative gross margin is between one-third and one-half. Using the illustrative efficiency deduction of  $e = 10\%$ , with a relative gross margin of one-third, equation (2) holds if the diversion ratio is at least 20%; with a relative gross margin of one-half, equation (2) holds if the diversion ratio is at least 10%. Armed with these figures, one need not develop a precise

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<sup>30</sup> See for instance UK Competition Commission, August 2008.

<sup>31</sup> On unilateral effects in bidding markets, see Gregory Werden and Luke Froeb (2007) and Klemperer (2007).

<sup>32</sup> In a single sealed-bid auction, responses are not possible, so there is no need for any analog to the residual diversion ratio as distinct from the conventional diversion ratio. However, if more aggressive bidding in one auction will affect rivals' bidding in subsequent auctions, this is a reaction very similar to that in posted-price markets.

estimate of the diversion ratio if one can conclude that it is clearly more than 20%. That conclusion would indicate upward pricing pressure.<sup>33</sup>

### 3. Pass-Through: From Pricing Pressure to Competitive Effect

In principle, one would like to estimate the magnitude of any post-merger price increases.<sup>34</sup> We now consider what additional information and analysis would be required to predict such price changes. We explain why we believe that such predictions, while potentially a valuable part of the full merger analysis, are too complex to be included in a simple test suitable for establishing presumptions.<sup>35</sup> Specifically, we show why it is generally much easier to predict the *sign* of the price effects resulting from a merger, as our test aims to do, than to predict their *magnitude*.

We have emphasized that internalizing the cannibalization of sales of the rival's product creates an opportunity cost that was absent prior to the merger. Pursuing this idea one step further, the price effects of a merger can be thought of as resulting from an increase in costs, where the cost increase reflects this opportunity cost arising from cannibalization:

**Proposition 2:** The corporate headquarters can decentralize the post-merger equilibrium prices  $P_1^*$  and  $P_2^*$  by imposing taxes  $t_1^* = D_{12}(P_2^* - C_2)$  and  $t_2^* = D_{21}(P_1^* - C_1)$ .

**Proof:** These taxes internalize the externality imposed on the other division when one division sells one more unit. Therefore, the first-order condition for divisional profits, at the post-merger prices, is the same as the first-order condition for joint profit maximization.

For a merger that generates the default efficiencies, the post-merger price increases are those that would result from an increase in marginal cost of  $t_1^* - e\bar{C}_1$  on Product 1 and likewise for Product 2, with no cost-function change for other market participants. This observation does not provide a constructive method of calculating the post-merger price increases, because the required tax rates themselves depend upon the post-merger prices. But it shows that we can think of the price effects of a merger as resulting from a shift in the (opportunity) costs for the products sold by the merging firms, without any change in industry structure.

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<sup>33</sup> Antitrust analysis of mergers has not always coped well with uncertainty: see Katz and Shelanski (2007).

<sup>34</sup> Strictly, of course, one wants to compare what will happen if the merger takes place with what will happen (from now on) if it does not; the language of "post-merger" versus "pre-merger" outcomes is well established as a shorthand for this comparison.

<sup>35</sup> We are referring here to a structural estimation of price effects, such as are done in merger simulation. We do not intend to rule out the possibility of using direct evidence for this purpose, e.g., by comparing prices in geographic markets before and after the entry or exit by one of the merging firms. Such direct evidence might be another way for the government to establish a presumption that the proposed merger will harm customers.

Taking this perspective highlights the importance for merger analysis of the rate at which cost increases are passed through into higher prices by the merging firms.<sup>36</sup> Importantly, the relevant pass-through rates are *equilibrium* pass-through rates: how much do the prices of the various products rise in response to positive cost shocks for the products sold by the merging firms?<sup>37</sup>

And therein lies one of the biggest differences between our approach, based on UPP, and any approach relying on the magnitude of the predicted price increases: pass-through rates simply did not enter into our test. When there is UPP for both products, pass-through rates affect the magnitude, not the sign, of the price changes resulting from the merger.

More specifically, the price effects of the merger depend upon the rates at which an asymmetric pair of cost shocks, namely  $t_1^* - e\bar{C}_1$  and  $t_2^* - e\bar{C}_2$  for Products 1 and 2 and no cost changes for products sold by other firms, would be passed through, in equilibrium, in the form of higher prices. Fundamentally, then, predicting price effects requires one to estimate such pass-through rates. More modestly, one could seek a lower bound on the post-merger prices by asking how cost shocks of  $\bar{t}_1 - e\bar{C}_1$  and  $\bar{t}_2 - e\bar{C}_2$  would be passed-through. But one would still need to estimate oligopoly pass-through rates.

Unfortunately, there is no easy way to recover information about pass-through rates of single-firm or two-firm cost shocks based on simple measurements of pre-merger variables. One can make some inferences about the elasticity (and thus the slope) of the demand for one of the firm's products based on its pre-merger margins. But single-firm pass-through rates depend upon the curvature of demand, which is much harder to measure, at least through demand estimation, and equilibrium pass-through rates depend upon the shape of the entire demand system.

One special cast of this, which could be phrased as an objection to our approach, is that the equilibrium pass-through rates might be very low, in which case the predicted price effects of the merger would be modest, even if there is UPP for both products and even before accounting for entry and product repositioning. We agree this is theoretically possible; and it might be worth exploring at part of the back-end analysis. But observing that the merging firms operate in a reasonably competitive differentiated-product industry does *not* establish that pass-through rates are low.

Economics has clear and intuitive results about perfectly-competitive pass-through of industry-wide cost shocks, as developed particularly in the public finance literature. We also understand monopoly pass-through of a single-product cost shock; it depends on the curvature as well as the elasticity of the product's residual demand curve; see Bulow and Pfleiderer (1983). Curvature is difficult to estimate reliably and is almost always assumed (via the choice of functional form for

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<sup>36</sup> This idea is developed further in our companion paper, "Cannibalization, Pass-Through, and Market Definition."

<sup>37</sup> Such equilibrium pass-through rates are different from single-firm pass-through rates, which measure how much a firm raises its price if its marginal cost rises, taking as given the prices of all other products, and thus taking as given the demand curve facing the firm. Such single-firm pass-through rates depend upon the curvature of the firm-specific demand curve. See Bulow and Pfleiderer (1984).

the demand system) rather than studied.<sup>38</sup> In particular, the choice of functional form imposes a link between estimated point elasticity and estimated curvature.

Equilibrium pass-through of an asymmetric cost shock in oligopoly has been relatively little studied. But we do know, as a theoretical matter, that the pass-through rates for firm-specific cost shocks can be surprisingly large even in a reasonably competitive industry.<sup>39</sup> In a differentiated product oligopoly, if each firm faces a high but constant elasticity of demand, the firm-specific pass-through rates are greater than 100%. In a Cournot oligopoly with  $N$  active firms and linear demand, the equilibrium pass-through rate of firm-specific cost shocks is equal to  $1/(N+1)$ , which can still be significant in a moderately concentrated oligopoly.<sup>40</sup> Dornbusch (1987) analyzes pass-through of a shock to some but not all firms in several models of oligopoly, as might occur with an exchange-rate movement. The empirical literature on oligopoly pass-through of asymmetric cost shocks is dominated by international-trade studies of the pass-through of exchange-rate movements.<sup>41</sup>

Given Proposition 2, it is not surprising that some arguments familiar from antitrust litigation can be phrased in terms of pass-through. In particular, merging firms often argue either that they should be viewed as only two firms among a large number in a broadly Bergstrom-Varian-Dornbusch mental model, or that industry demand becomes much more elastic for price increases than for price decreases, which would imply low pass-through rates.

Because pass-through is very different with different demand systems, merger simulations that assume different functional forms for demand will predict very different price impacts of a given merger (before considering efficiencies); see particularly Froeb et al. (2005). Because the magnitude of post-merger price increases varies so much with these somewhat arcane assumptions, for reasons that are opaque to non-economists, the methodology is hard to make robust and transparent. For this reason we believe it is better to base the presumption on the magnitude of the cannibalization term, leaving the difficult and problematic debate about pass-through rates to later investigation if ever.

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<sup>38</sup> See for instance Froeb et. al. (1999), (2005). In a merger simulation context, they observe that the estimated pass-through of merger efficiencies depends on the choice of demand system, and that demand systems that yield higher estimates of pass-through of efficiencies also yield higher “competitive effects” (predicted price increases on the assumption of no efficiencies). They do not note, as our Proposition 2 does, that this is because competitive effects are the pass-through of the cannibalization terms.

<sup>39</sup> The relevant pass-through rates are the *equilibrium* pass-through rates, with the prices of all firms adjusting to the cost shock by one firm. These are higher than the theoretical pass-through rates taking as given the prices of all other firms, as in Bulow and Pfleiderer (1983).

<sup>40</sup> See Bergstrom and Varian (1985).

<sup>41</sup> Goldberg and Knetter (1997) report finding 700 articles on this topic. The research shows that a change in (say) the yen/dollar exchange rate is very substantially, though by no means fully, proportionally reflected in US prices of cards imported to the US from Japan. It also finds that the extent to which this is true is very variable.

## 4. Direct Rebuttal of the Presumption

Real-world mergers are invariably complex. They certainly cannot be fully analyzed with any simple method, be it the traditional HHI thresholds or our UPP test. Therefore, it is essential that the merging parties be given the opportunity to rebut any presumption that was based on a simple test. And the strength of the presumption should depend upon how meaningful and powerful the test results are judged to be in the case at hand.

In cases where upward pricing pressure has been demonstrated, there are a number of routes that the merging firms can take to rebut directly the presumption of harm to customers.<sup>42</sup> By “direct rebuttal” we mean a frontal assault on the relevance of the test results themselves.<sup>43</sup> We address other means of rebuttal, including product repositioning, entry, and efficiencies, below. In this section, we show how to account for divergences between the actual market structure and the simple model of single-product Bertrand duopoly used to derive the UPP test.

### *A. Mixed Test Results*

Proposition 1 tells us that a merger with the default level of efficiencies will lead to higher prices in Bertrand duopoly if there is UPP for both products. Proposition 1 does not apply if there is UPP for one product and downward pricing pressure for the other, as for instance if inequality (1) generated a positive test result for Product 1 (say) and a negative test result for Product 2.

The merging parties might rebut any presumption that the merger will lead to higher prices in the case of mixed test results by showing that a merger with the default level of efficiencies will increase overall consumer surplus. We have not yet developed specific methods by which this could be shown, short of a full back-end analysis estimating the price effects of the merger, but there may well be some useful shortcuts. For example, one might make the working assumption (related to assuming equal pass-through rates) that the ratio of the price increase for Product 1 to the absolute value of the price decrease for Product 2 is equal to the ratio of the UPP for Product 2 to the DPP for Product 2. For small price changes, the change in consumer surplus is proportional to the change in price times the number of units purchased. Armed with information about the quantities sold of Products 1 and 2, a simple calculation could illuminate whether aggregate consumer surplus would rise or fall.

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<sup>42</sup> We are describing here the back and forth that would take place in court. As with all of the ways in which the government’s presumption can be rebutted, we anticipate and presume that the antitrust agencies would carefully study these issues before suing to block a proposed merger.

<sup>43</sup> The most direct rebuttal would involve challenging the government’s measurement of the variables used in the test, e.g., by claiming a lower diversion ratio than the government asserts. We have already discussed in broad terms how to measure margins and diversion ratios, so we do not dwell on these issues, as important as they may prove to be in practice.

## ***B. Complementary Products***

The merging firms could argue that the merger combines complementary products and thus creates downward pricing pressure that offsets UPP reflected in the test result. To evaluate this rebuttal argument, it is highly instructive to consider how  $\bar{t}_1 = D_{12}(\bar{P}_2 - \bar{C}_2)$  is affected if the merging firms control multiple products pre-merger.

If Firm A owns just Product 1 while Firm B owns Products 2, ...,  $n$ ,<sup>44</sup> we have:

$$\bar{t}_1 = \sum_{j=2}^n D_{1j}(\bar{P}_j - \bar{C}_j).$$

This formulation also covers complementary products. Suppose that Firm B's Product 3 is a *complement* to Product 1. Combining Product 1 and Product 3 encourages the merged firm to lower the price of Product 1, since that will spur sales of Product 3. This is captured in that  $D_{13}$  will be negative. If Firm B only sells substitute Product 2 and complement Product 3, and if  $\bar{t}_1 = D_{12}(\bar{P}_2 - \bar{C}_2) + D_{13}(\bar{P}_3 - \bar{C}_3) < e\bar{C}_1$ , there would be no UPP and the presumption would be rebutted.

This line of analysis shows, incidentally, how the government can modify inequality (1) when Firm B sells several products that are substitutes to Product 1. In practice one can often simplify by aggregating "products." For example, if Firm B owns several (narrowly defined) products with roughly equal absolute gross margins, the test only requires that one estimate the diversion ratio from Product 1 to those products as a group. Similarly, if Firms A and B primarily compete for customers who then buy multiple (narrowly defined) "products," it may be adequate to evaluate the gross profit margin on "a customer" and the diversion ratio in customers. The government could include these effects in the initial test or in a modified test in response to direct rebuttal arguments by the merging firms.

## **5. Full Analysis of Competitive Effects**

If the merging parties are not able directly to rebut the presumption of higher prices based on a showing that the merger will create UPP for one or more products, they can still rebut that presumption based on a more complete analysis of competitive effects. We envision this back-end analysis looking much like it does under current practice, focusing on product repositioning, entry, and efficiencies, as described in Sections 3 and 4 of the Guidelines. One can think of these defenses in terms of inequality (1): product repositioning and entry lead to a lower diversion ratio term than prevails in their absence, and efficiencies that exceed the default level can be larger than the opportunity cost term reflecting cannibalization.

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<sup>44</sup> We leave for future work how to formally test for UPP for Product 1 in situations where Firm A owns multiple products that interact on the demand side. While the basic intuition about opportunity cost is robust, this case is considerably more technically complex than the one discussed here.

## 6. Comparison with Concentration Approach and with Merger Simulation

Many economists share our concern that the approach based on market definition and concentration has come to occupy too commanding a position in merger analysis. Antitrust economists routinely remark that market definition under the Guidelines can be a distraction and does not really get at the important questions arising in merger analysis.<sup>45</sup>

For many economists, a natural alternative to the market definition approach would be to (a) model the industry and the nature of competition, (b) calibrate the model using pre-merger data, and then (c) use the calibrated model to predict post-merger prices.<sup>46</sup> This general approach is often called “merger simulation.” Our analysis uncovers the fact that merger simulation must implicitly or explicitly estimate the pass-through rate of the asymmetric cost shock described in Proposition 2. It is therefore unsurprising that, as Froeb et. al.(2005) found, the price predictions resulting from merger simulation depend very strongly on the demand system used. This often creates a battle of the experts, and although merger simulation is used by the antitrust agencies and by merging parties arguing before the agencies, we are not aware that any judge has accepted merger simulation as primary evidence on whether a merger would harm competition.<sup>47</sup>

Merger simulation also takes on more than necessary: it seeks to fit a structural model to historical industry data (back-casting) and then use that model to predict price levels after the merger (fore-casting). As such, it tries to explain price *levels*. In simple industries this may be all very well, but in more complex markets it risks mis-specification by omitting the less immediate and concrete aspects of firms’ objectives and conduct.<sup>48</sup> Our focus on pricing pressure at the marginal-cost level automatically nets out such complexities that are present both before and after the merger, because it focuses on the *net change* in marginal cost, which is simple to calculate at pre-merger price and cost levels and robustly gives us a sufficient condition for prices to rise, while admittedly not telling us by how much.

Market definition using the “hypothetical monopolist test” in the Guidelines also hinges on pass-through: indeed, it is (very closely related to) simulation of a hypothetical (typically broader than proposed) merger.<sup>49</sup> While useful in many settings, in cases involving differentiated products

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<sup>45</sup> [Add citations critical of market definition in merger cases. Cite to specific cases: Staples. Evanston Hospital.]

<sup>46</sup> Another alternative is to rely on “natural experiments” to observe directly market outcomes with and without competition between the merging parties. This is very valuable information that could make it unnecessary to engage separately in the market definition exercise (or to use our diagnostic test). We think of such natural experiments as potential direct proof of anti-competitive effects, obviating the need to conduct any simple test designed to establish a presumption.

<sup>47</sup> For a recent survey of the use of merger simulation in litigation, see e.g. Budzinski and Ruhmer (2008).

<sup>48</sup> Merger simulation sometimes “backs out” estimates of marginal costs from firms’ pricing choices, in which case it might capture these effects through the back door. As far as we know, however, this has not been thoroughly explored in the merger simulation literature.

<sup>49</sup> Market definition via Critical Loss Analysis in practice also often fails to focus on the *change* in incentives to raise price. By instead attempting to model post-merger pricing incentives from scratch, some experts engaged in Critical Loss Analysis have been led to opine that a hypothetical monopolist would face such elastic demand that it

the market definition procedure in the Guidelines has other problems too numerous to mention here. A number of these problems stem from the fact that the Guidelines ask about a the pricing incentives of a hypothetical monopolist that may look nothing like either of the merging parties, and from the procedure for adding products in order of “closest substitutes” combined with the “narrowest market” principle.

## 7. Innovation Competition

So far, we have focused entirely on pricing competition. This focus reflects the general Gestalt of the Merger Guidelines, and the notion that pricing incentives may be a good proxy for incentives to compete on other dimensions. However, in markets where innovation competition is central, the impact of a merger on pricing incentives might not match up very closely with its impact on innovation incentives. For example, the two firms might not currently offer directly competing products, but they could both be working on new products that will compete more directly, either with each other or with the firms’ current offerings. In such settings, a key question is not whether the merger will lead to higher prices in the near term, but whether the merger will lead to less rapid innovation over a longer time horizon.<sup>50</sup>

If Firm A devotes more resources to improving its products, it will (on average) increase its operating profits (gross of its R&D expenditures) and reduce Firm B’s profits. This simple logic leads to what might be called the “innovation diversion ratio,” as distinct from the usual (pricing) diversion ratio. The innovation diversion ratio from Firm A to Firm B is the fraction  $I_{AB}$  of the extra gross profits earned by Firm A when it devotes more resources to innovation that come at the expense of Firm B.

To illustrate, suppose that Firm A is considering a risky R&D investment that, if it succeeds, will yield \$100 million in profits for A and reduce B’s profits by \$30 million. Since 30% of the extra profits to Firm A come at the expense of Firm B,  $I_{AB} = 30\%$ . Relative to pre-merger incentives, the merger effectively puts a 30% cannibalization tax on the fruits of R&D investments by Firm A. Against this tax, the merger may generate some R&D efficiencies, e.g., by allowing the two firms to combine their R&D teams. Another possible source of efficiency arises if the merged entity can internalize spillovers that would otherwise arise when Firm B benefits from Firm A’s innovation, as when Firm B can copy Firm A’s innovation without infringing Firm A’s intellectual property, or when Firm B can capture gains from trade by licensing intellectual property from Firm A. As in the pricing analysis above, mergers might be credited with some standard level  $e$  of R&D efficiencies, which means that the cost of R&D falls by a factor  $1 - e$ .

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would have an incentive to lower the price below pre-merger levels, a glaring problem with the methodology. Werden (2008) refers to this as “Critical Loss Analysis by Defendants.”

<sup>50</sup> A reasonable case can be made that protecting innovation might also involve protecting diversity of approaches and visions of the market, and thus be somewhat less incentive-focused than is the case with pricing competition. But certainly a change in innovation incentives would be important for the analysis.

Following this logic, a proposed merger between Firms A and B will tend to retard innovation on Firm A's products if

$$I_{AB} > e. \quad (3)$$

In markets where innovation is important and may be slowed down by a proposed merger, the government might establish a presumption of harm to innovation if inequality (3) is satisfied.

The innovation diversion ratio in a given case may well be hard to estimate. Likewise, the default level of innovation efficiencies to be applied in general may well be hard to establish. But these are not gratuitous difficulties. The impact of the proposed merger on innovation incentives really does depend on the extent to which Firm A's pre-merger rewards from innovation came at the expense of Firm B and on merger efficiencies relating to innovation. We also include this case to stress the fundamental breadth of the idea of viewing merger effects through opportunity cost.

## 8. Conclusion

We have put forward a simple diagnostic test to detect horizontal mergers that are most likely to lead to unilateral anti-competitive effects. We argued that our approach is simpler, more disciplined, and more reliable than the current method of establishing a presumption based on market definition and concentration. Pending convincing empirical comparisons of different approaches to establishing merger presumptions, there are strong *a priori* reasons to favor our approach.<sup>51</sup> It is more solidly grounded in the underlying economics of unilateral effects than the market definition/concentration approach currently practiced.

We recognize that our proposed test is a significant departure from the *Guidelines* and may raise issues under current case law. We also recognize that our approach will not be suitable for all cases; we have focused our attention on cases involving differentiated products. We are only proposing our test as an alternative, for use in selected cases, to the market definition/concentration steps in the *Guidelines*, not as a replacement for those steps.

The FTC Workshop on Unilateral Effects earlier this year convinces us that the time is right to modify the *Guidelines* to incorporate our test. Several former government officials indicated that the agencies often look for evidence of competitive effects, along the lines of our test, and then "back out" a market definition as necessary for litigation. This suggests that the market definition exercise is a distracting appendage to the "real" analysis of mergers with unilateral

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<sup>51</sup> Ideally, the reliability of different methods of evaluating proposed mergers should be gauged by an intelligent combination of theoretical analysis and empirical evaluation. The most direct way to do this is to look at completed mergers and compare the observed changes against pre-merger predictions using various methods. Regrettably, retrospective studies of the effects of mergers have been scarce and limited in scope. And, when mergers have been evaluated *ex post*, rarely are the observed effects compared with *ex ante* predictions. Dennis Carlton (2007) recently called for just this type of empirical research program. See Pautler (2003), Kaplow and Shapiro (2007), and Weinberg (2007) for further information on merger retrospectives.

effects. And if the agencies are not following their own *Guidelines*, transparency and honesty calls for a revision.

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