

Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition[†]

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Abstract

We propose a simple, new test for making an initial determination of whether a proposed merger between rivals is likely to reduce competition and thus lead to higher prices. Under current antitrust policy, the government can establish a presumption that a proposed horizontal merger will harm competition by defining the relevant market and showing that the merger will lead to a substantial increase in concentration in that market. However, this approach can perform poorly in markets for differentiated products, where market boundaries are unclear and the proximity of the products sold by the merging firms is a key determinant of the merger's effect on competition. Our test looks for upward pricing pressure (UPP) resulting from the merger. We develop a simple diagnostic for UPP based on the price/cost margins of the products sold by the merging firms and the magnitude of direct substitution between the two firm's products. We argue that our approach is well grounded in economics, workable in practice, and superior to existing methods in a substantial class of mergers.

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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.¹ 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.² 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. Under the 1976 Hart-Scott-Rodino Act, merging parties must generally notify the DOJ and the FTC of a substantial proposed merger.³ 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.⁴ For the agency to block a merger, it must convince a Federal judge that the merger’s effect “may be substantially to lessen competition, or to tend to create a monopoly.”⁵

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 prove to a court that a merger will certainly cause anti-competitive effects. One can read the Clayton Act’s choice of the word “may” as recognizing this difficulty and ruling that the government need not strictly *prove* anticompetitive effects. Effective pre-merger control must provide the antitrust agencies a relatively simple means of establishing a rebuttable *presumption* that a proposed merger will harm competition.⁶

¹ “Hart-Scott-Rodino Annual Report, Fiscal Year 2007,” <http://www.ftc.gov/os/2008/11/hsrreportfy2007.pdf> . In Fiscal 2007, there were 303 HSR transactions each valued at more than \$1 billion (Ibid., Exhibit A, Table I).

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

³ The “size of transaction” threshold was set at \$50 million in 2000 and indexed to GNP; it is \$63 million in 2008.

⁴ 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 information from the merging parties, the antitrust agencies can subpoena information from others, using a “civil investigative demand,” to help in evaluating a proposed merger.

⁵ This language is from Section 7 of the 1914 Clayton Act, as amended in 1950. The procedure is somewhat different for the FTC versus for the DOJ. Much bargaining takes place in the shadow of the statute, and many more mergers are abandoned “voluntarily” by the parties, or modified under 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 cases. The agencies challenged 32, leading to 17 settlements with the merging parties, 6 restructured transactions, and 9 abandoned transactions. The DOJ has litigated only one merger case in the past four years, during which time the FTC has litigated roughly one merger case per year.

⁶ That is, once this presumption is established, the burden shifts to the merging parties to show that their proposed merger will *not* harm competition.

This 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 in detail below, that approach can be needlessly roundabout and inaccurate in industries with differentiated products.

In this paper, drawing heavily on ideas developed by Werden (1996) and by O’Brien and Salop (2000), we put forward an alternative approach to establishing a presumption of anti-competitive effects. This approach, based directly on the underlying economics of pricing competition in oligopoly, asks whether the proposed merger will generate net upward pricing pressure (UPP). This involves comparing two opposing forces: the loss of direct competition between the merging parties, which creates upward pricing pressure, and marginal-cost savings from the merger, which create (offsetting) downward pricing pressure. In the pure form of our test, the merger is presumed to be anti-competitive if the net effect of these two forces is upward pricing pressure. We show how these forces can be compared *without* working out the full equilibrium adjustment of the industry to the proposed merger. We also sketch some modified forms of our test that facilitate comparison with existing practice.

While our approach offers 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;
- (2) Each approach involves a simple test that reflects a core economic idea about the change in pricing incentives resulting from a merger. Conceptually, the market concentration approach (as it applies to concerns about unilateral effects) is inspired by the fact that higher share lowers a firm’s marginal revenue in Cournot oligopoly with homogeneous products, while our approach derives from Bertrand 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 concern; in our case, by choosing how much credit to give for 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 any presumption.

We argue that our approach is simpler and more accurate than the approach based on market concentration in a very important category of mergers: those in industries where firms compete on price to sell differentiated products. We follow existing practice in such mergers by focusing

initially on “unilateral effects” (described below) and assessing the change in pricing incentives due to the proposed merger.⁷

1. Problems with the Presumption Based on Concentration

For almost half a century, merger control policy has relied on the presumption that a merger which substantially increases market concentration is likely to be anti-competitive. In the landmark 1963 *Philadelphia National Bank* case, the Supreme Court held:⁸

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” drew on the then-dominant structure-conduct-performance paradigm in industrial organization economics, which linked increases in concentration to declines in market performance. In recent decades, however, industrial organization scholars and the courts have been more apt to stress that high concentration can be compatible with vigorous competition and efficient market performance. Thus, while *Philadelphia National Bank* has never been overruled, its presumption has greatly weakened over the past 30 years.⁹

As explained in their *Horizontal Merger Guidelines* (“Guidelines”), the agencies consider two basic theories of anti-competitive effects.¹⁰ “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 raise prices (or otherwise harm consumers).¹¹ The DOJ and the FTC have perhaps the largest concentrations of Ph.D. industrial organization economists in the world, and they do not mechanically rely on concentration and market shares, but seek flexibly to understand the economics of the industry. Economic analysis of unilateral effects, in particular, has advanced greatly in recent decades, but the Guidelines remain oriented towards invoking the *Philadelphia National Bank* presumption in litigation (despite its decreasing force), and try to shoehorn modern economics into the structural

⁷ On aspects of merger policy beyond the immediately proposed merger see e.g. Lyons (2002) and Nocke and Whinston (2008). Since firms, like other human organizations, probably do not reliably optimize, policy could consider a less intense focus on incentives and more focus on biodiversity-like concepts of resilience; but here we stick to the standard approach.

⁸ *United States v. Philadelphia National Bank*, 374 U.S. 321, 363 (1963).

⁹ On the decline of the structural presumption, see Jonathan Baker and Carl Shapiro (2008).

¹⁰ The Guidelines are available at <http://www.usdoj.gov/atr/public/premerger.htm>.

¹¹ In practice the concept of “unilateral effects” is sometimes interpreted as “effects within a static oligopoly model.” A more general definition, which we adopt here, is “effects of a change in the merging firms’ choices, holding fixed other firms’ reaction functions.” See Werden and Froeb (2007) for an extended discussion of unilateral effects in mergers.

framework. Thus the Guidelines begin by defining the relevant market, and stress market concentration as a signal of competitive effects. This mismatch has created a tangle of problems.

The problems are particularly pronounced in the large class of mergers in which the merging firms sell differentiated products and the agencies are concerned about unilateral effects. This class probably includes most mergers in retailing, branded consumer products, computer hardware and software, and information content (magazines, newspapers, music, video programming). Because of the differentiation, defining the relevant market can be problematic, and the link between market shares and competitive effects can be weak and/or confusing. 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, all beer, all alcoholic beverages, or all beverages? Such definitional questions are typically central in court, while economists wonder how the outcome of a merger case can turn on an inevitably somewhat artificial and arbitrary line-drawing exercise.¹²

Seeking to address this arbitrariness, the Guidelines offer a specific and theoretically well-defined algorithm for market definition, the so-called “hypothetical monopolist” test, under which a “relevant market” is a collection of substitute products that could profitably be monopolized. When gross margins are substantial, Shapiro (1996) and Katz and Shapiro (2003) showed that this algorithm often leads to relatively narrow markets.¹³ But the merging parties (who typically argue for broader markets, in which their shares are smaller) can point to some competition between their products and products outside a Guidelines market or other relatively narrow proposed market. Courts have been inclined to define markets relatively broadly, including all “reasonable substitutes” to the products offered by the merging firms.¹⁴ Thus the agencies have not always succeeded when they have gone to court advancing relevant markets based on the algorithm from the Guidelines.

Consider for instance 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’ CEO, John Mackey, told his Board of Directors: “[b]y buying [Wild Oats] we will *** avoid nasty price wars in [various] cities which will harm our gross margins and profitability,”¹⁵ and stated that: “One of the motivations is to eliminate a competitor. *** That is one of the reasons we are

¹² 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 boundaries that are inevitably somewhat arbitrary.

¹³ This seemingly straightforward fact has itself become controversial; see recently Farrell and Shapiro (2008) and the papers cited there.

¹⁴ As the District Court in *Whole Foods* stated (p. 13), quoting *Microsoft*: “A market ‘must include all products reasonably interchangeable by consumers for the same purposes.’ By contrast, a *Guidelines*-defined market includes only enough substitutes so that a hypothetical monopolist would find it profitable to impose a small but significant increase in price.

¹⁵ 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.

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."¹⁶

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."¹⁷ Seeking to express this 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."

But of course Whole Foods' customers can buy groceries—even many organic foods—at Safeway too: patrons of Whole Foods and Wild Oats also "cross shop" at traditional supermarkets. Thus the District 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."¹⁸ The Court stated (at 5):

[I]f 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.

Whether or not the merger between Whole Foods and Wild Oats was anticompetitive, the market definition inquiry addressed that question at best indirectly. Only clumsily could it 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. Neither answer seems a good way of expressing substantial-but-not-overwhelming product differentiation. Neither fits well with the economic way of thinking. In this paper we explore an approach that draws much more directly on very basic and general economic principles.¹⁹

¹⁶ Ibid. p. 12.

¹⁷ 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.

¹⁸ 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.

¹⁹ 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 high-function human relations management (HRM) and financial management systems (FMS) software, for which their proposed merger would have reduced the number of major competitors from three to two, with SAP being the chief rival to

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.²⁰ When rivals merge, there are two direct effects on pricing incentives. First, the merging firms no longer compete with each other to attract customers: this generically encourages higher prices.²¹ Second, the firms' assets can now be managed jointly to achieve efficiencies: this can lower marginal costs, encouraging lower prices.

We next quantify the loss of direct competition in terms that can be directly compared against estimates of marginal-cost efficiencies. We then specialize the extremely robust and general underlying economic idea to the standard Bertrand setting.

A. Quantifying the Cannibalization Effect

Consider a merger between Firms A and B, whose profits are denoted by π_A and π_B . Before the merger, Firm A set prices and perhaps made other decisions (advertising, R&D spending, etc.) to sell its products, and likewise for Firm B. Following a standard idea in unilateral-effect analysis, think of the merged firm as operating what had been Firms A and B instead as Divisions A and B. Suppose, for this sub-section, that the merger involves no efficiencies.

Consider a sales-boosting variable s chosen by Firm A before the merger. The merger changes incentives because the merged firm newly takes into account the impact of s on π_B . If Firms A and B are rivals, an increase in s by Firm A typically will lower π_B . After the merger, sales won by Division A when it increases s are cannibalized from Division B.

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.

²⁰ 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 partly reflects the fact that U.S. antitrust law generally evaluates mergers based on their impact on consumers. 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>.

²¹ In some models, and perhaps in some real oligopolies, some horizontal mergers lead to *no* loss of competition. For example, in a Cournot industry in which all firms produce at low marginal cost up to capacity, after a merger that 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.

Using the implicit function theorem, the change in the profit-maximizing level of s resulting from the merger can be gauged by $\pi_B'(s)/[-\pi_A''(s)]$.²² But, as we discuss in Section 3, estimating the second derivative, $\pi_A''(s)$, is often particularly difficult. In the case of a single firm setting its price, the second derivative of the firm's profits with respect to its price depends upon the curvature of the residual demand curve facing the firm. In an oligopoly context, this second derivative no longer depends upon the properties of a single-firm optimization problem. One must account for how Firm A's rivals will respond if Firm A changes its price, leading to an equilibrium comparative statics problem. This is not the stuff of simple rules on which presumptions can be based. We thus propose that a test to establish a presumption of harm to competition should not rely on merger-specific estimates of the magnitude of the merger's effects on competitive variables such as price.

Instead, we quantify the merger's effects by conceptualizing the cannibalization effect as an opportunity cost to Firm A of selling more of its products. Suppose that Firm A sells Product 1 and when Firm A increases s it stimulates the sales of Product 1 according to $x_1(s)$. The merger causes Division A to internalize the effect of s on π_B . This has the same impact on s -incentives as a per-unit tax of $-\pi_B'(s)/x_1'(s)$ on Product 1.²³ These first-derivative terms are likely to be much easier to estimate than terms based on second derivatives. The fundamental idea of our approach is that when this tax is substantial, one can expect a reduction in s and hence in the output of Product 1.

While this core idea is very general, we now make it more concrete by specializing to the simple case where Firms A and B are single-product static Bertrand competitors with differentiated products. 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 ; bars denote pre-merger values of all variables. Their pre-merger marginal costs are denoted by \bar{C}_1 and \bar{C}_2 respectively.

After Firms A and B merge, corporate headquarters wants Division A, which sells Product 1, and Division B, which sells Product 2, to set prices to maximize joint profits. If the two divisions go on behaving the way they did as separate firms, they will compete against each other, reducing overall corporate profits; Bertrand equilibrium prices are below the prices that maximize joint profits. Headquarters can control this cannibalization in a decentralized manner by imposing an internal tax on each Division that internalizes the externality imposed when that division captures business from the other by cutting its price, and then letting each Division maximize its profits, net of these internal taxes.

²² More precisely, if one thinks of Firm A purchasing a small share θ of Firm B, and if one holds fixed Firm B's strategy, then $ds/d\theta \approx -\pi_B'(s)/\pi_A''(s)$.

²³ In general, Firm A may choose several strategic variables, including various prices, each of which affects the sales of Product 1 and Firm B's profits. The ratio can differ for the different variables. We focus on the own-price effect.

Proposition 2 below characterizes the tax that supports the new profit optimum, but calculating it requires knowing the price effects of the merger, so it is not helpful in estimating those effects. But it is simple to calculate the first-round value of the tax—that is, the inter-division externality

calculated at pre-merger prices and outputs. This first-round tax on Product 1 is $\bar{t}_1 \equiv \left. \frac{d\pi_B}{dX_1} \right|$, or

$\bar{t}_1 \equiv \left. \frac{d\pi_B}{dX_2} \right| \frac{dX_2}{dX_1}$. Here $\left. \frac{d\pi_B}{dX_2} \right|$ is the increase in Firm B's profits if sales of Product 2 rise by one

unit, holding fixed its price: that is, the absolute gross margin, $\bar{P}_2 - \bar{C}_2$. The term $\left. \frac{dX_2}{dX_1} \right|$ measures the impact on sales of Product 2 when P_1 falls by enough to sell one more unit of Product 1: this is the diversion ratio from Product 1 to Product 2, at pre-merger prices, or D_{12} . Therefore, first-round tax on Product 1 is equal to

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

By the same logic, the first-round tax on Product 2 is $\bar{t}_2 = D_{21}(\bar{P}_1 - \bar{C}_1)$. Since Products 1 and 2 are substitutes, \bar{t}_1, \bar{t}_2 are both positive.

Starting with these taxes, the effect of the merger can be calculated using the following iterative procedure: (a) impose internal taxes \bar{t}_1, \bar{t}_2 on Divisions A and B; (b) allow the oligopoly to re-equilibrate;²⁴ (c) re-calculate the internal taxes at these new prices and outputs; and then (d) repeating steps (a) through (c) until convergence. This claim assumes that the reaction functions of firms other than Firms A and B do not shift as a result of the merger. As noted above, this is the general definition of “unilateral effects” that we adopt here.

The motive force behind the unilateral price 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. The cost functions for rival products sold by third firms do not shift, and the broad concept of “unilateral effects” assumes that those firms' reaction functions do not shift either. In a very broad class of oligopoly games, including all reasonable Bertrand models, an increase in some firms' marginal costs, with no shift in those of the other firms, raises equilibrium prices.²⁵ We express this very general idea by saying that the loss of competition between Firms A and B will cause upward pricing pressure (UPP).

We thus view \bar{t}_1 as a measure of the risk that the price of Product 1 will rise as a result of this loss of competition. But it would be a radical (and highly questionable) policy to forbid all

²⁴ Since prices are strategic complements, re-equilibration raises prices at each stage. So, with constant marginal costs and constant diversion ratios, the tax rates must rise at each stage. Echenique (2002) shows that with strategic complements one can analyze equilibrium comparative statics of stable equilibria using this kind of dynamics.

²⁵ See, for example, Deneckere and Davidson (1985).

mergers involving some Product 1 with $\bar{t}_1 > 0$, and it would presumably be wasteful overkill to flag all such mergers as presumptively problematic. Rather, one would look for \bar{t}_1 to be in some sense “substantial,” and indeed the Clayton Act refers to a “substantial” harm to competition.

In Subsections B and C, we present a clean and simple interpretation of what is “substantial” that fits well with widespread assertions that (a) merger enforcement’s goal is to protect consumers against price increases due to loss of competition, and that (b) there is no “tolerance” for small anticompetitive price increases. We then discuss some broader interpretations.

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 upward pricing pressure \bar{t}_1 just discussed. Because \bar{t}_1 is a virtual marginal cost, it is directly comparable with marginal-cost efficiencies.

In principle one could use all available information to quantify marginal-cost efficiencies from a proposed merger. But merger-specific efficiencies are often very hard to predict, even for the firms themselves but especially for antitrust agencies and courts. Since we are seeking a simple screen, we propose (in line with current practice) postponing any detailed evaluation of merger efficiencies until the post-screen stage discussed in Section 4 below. But there could be a range of ways to establish a default estimate of marginal-cost efficiencies.

The simplest approach would credit some default level of marginal-cost efficiencies for each overlap product, effectively presuming that merger synergies will reduce the marginal cost of each overlap product by some given fraction E , so that the efficiencies for Product 1 are assumed to be $E\bar{C}_1$. Following Warren-Boulton (1985), we call this the “standard deduction,” meaning that merging parties need not prove this level of efficiencies (“itemize”) to be credited with them.²⁶ The standard deduction could be set based on evidence of the efficiencies that commonly result from horizontal mergers. For simplicity, we assume this approach below, while recognizing that it may be too stark; for illustrative purposes, we take $E = 10\%$.

As we will see, however, some anomalies may be created by assuming that—for instance—a large product experiences significant efficiencies from merging with a small rival product. For this reason, as well as simply for improved accuracy, one might want to import more information into the allowances for marginal-cost efficiencies, for instance allowing for E_1 and E_2 to differ and depend on some simple predictors of efficiencies.²⁷ Aiming for too much accuracy, however, might sacrifice speed and transparency, as discussed in Section 7 below.

²⁶ Some observers see this approach, not necessarily explicitly, behind the established policy of allowing many horizontal mergers without special showings of efficiencies.

²⁷ For example, with declining marginal costs, at pre-merger output levels the merged firm will have a lower marginal cost than either merging firm, and the reduction in marginal cost will be larger for the smaller product.

C. Net Pricing Pressure

In its pure form, our test asks whether, on balance, the merger causes upward pricing pressure, which it does for Product 1 if the cannibalization term \bar{t}_1 exceeds the marginal-cost efficiencies credited at the screening stage, for instance through the standard deduction. This test thus flags mergers that “may significantly” harm competition in the sense that, net of credited efficiencies, they create upward pricing pressure.²⁸

If the merger creates net UPP for Product 1, basic economic theory unambiguously predicts that the price of Product 1 will rise, holding fixed other prices. 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. And it seems plausible that even a firm that does not maximize profits will typically raise its price in response to an increase in its marginal cost.

Net UPP shifts Product 1’s price *reaction function* upward.²⁹ Its equilibrium price could nevertheless fall, notably if Product 2 experiences net downward pricing pressure and the two products are strongly substitutable. When the two prices are strategic complements, the goods are demand substitutes (so that D is positive), and there is upward pricing pressure for both, then equilibrium prices certainly rise.³⁰ But strategic complements are far from necessary: for instance, in Cournot equilibrium, if some firms’ marginal costs rise and none fall, the price rises. We thus propose that net UPP should trigger a presumption—but not a final conclusion—that the merger is anticompetitive. As discussed in Section 4 below, downward pricing pressure on Product 2 may be a (sometimes quick) way to rebut the presumption, either by showing that neither price will actually rise, or by showing that a price increase on (say) Product 1 is outweighed, in consumer-surplus terms, by a price decrease on Product 2.

In general the gross upward pricing pressure term $-\pi_B'(s)/x_1'(s)$ depends on the nature of demand and oligopoly interactions, as we discuss in subsection F below. In pursuit of a tractable and transparent trigger for a presumption, we suggest that in most of the differentiated-product industries in which mergers might sensibly be proposed and sensibly be challenged, it will not be misleading to calculate this upward pricing pressure as if the industry were in Bertrand equilibrium. This simplification seems reasonably acceptable to yield a tractable screen, much as the concentration-based approach sets aside for later consideration many possible reasons why

²⁸ 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. In the pure form of our test we interpret “substantial” to mean “exceeding likely marginal-cost efficiencies,” as we explain below.

²⁹ As discussed below, it is possible that the price will barely rise, or in the extreme case remain unchanged, in response to strict UPP. We explain below why this possibility is best treated as a rebuttal to a presumption that net UPP will lead to a significant price increase.

³⁰ On comparative statics of equilibrium with strategic complements, see Milgrom and Shannon (1994) and Echenique (2002). A slight subtlety here is that each product’s marginal-cost function shifts upwards at pre-merger equilibrium and (if D is non-decreasing) at higher prices, but may shift downward at lower prices (since the gross cannibalization term is then lower).

concentration may not accurately gauge competitive effects. In the simple case of a merger between two single-product, Bertrand price-setting firms, the proposed merger creates net upward pricing pressure for Product 1 if

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

In a Bertrand industry, then, inequality (1) implies 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

$$D > E\left(\frac{1 - \bar{M}}{\bar{M}}\right) \quad (2)$$

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

D. Upward Pricing Pressure Leads to Higher Prices

This test 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} .³¹ We achieve this simplicity by asking only about the presence or absence of UPP, not about the *magnitude* of the price increase from the pre-merger to the post-merger equilibrium. As discussed below, that will depend in a much more complicated way on the overall demand system and on oligopoly conduct. Because that part of the analysis, if done correctly, is likely to be much more complex and less transparent than examination of condition (1), we propose that any such calculations, perhaps including full merger simulation, should await the back-end analysis conducted if an initial presumption based on UPP is found. Our focus on UPP is justified by the following Proposition; all proofs are in the Appendix:

Proposition 1: If there is net upward pricing pressure for both products, then a merger that generates no more than the default level of efficiencies will lead to higher prices for both products.

Proposition 1 provides a formal theoretical justification for our test, somewhat as results about Cournot equilibrium, or differentiated product competition with logit demand, formally justify a focus on concentration and shares. But our test has power because it captures the much 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 tests based on market shares have power because they capture the general idea that high share encourages output restriction by lowering marginal revenue.

³¹ Models of unilateral effects in price-setting games in which market shares matter typically reach this result by assuming that diversion ratios mirror shares: see Willig (1991) and our discussion in Section 6 below.

E. Simple Test Understates Competitive Concerns

The full cannibalization effects are augmented by three forces not reflected in inequality (1):

- If the price of Product 2 rises (as it will if there is net UPP on both products), that will raise the margin on Product 2 and elevate the cannibalization term for Product 1.
- 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, \bar{t}_1 .
- These effects operating on Products 1 and 2 reinforce each other.

Due to these effects, inequality (1) understates the competitive concerns, causing some false negative test results. As the cost of some complexity, these errors can be reduced.

In path breaking work, Werden (1996) calculates the “critical efficiencies” just sufficient to compensate for the loss of competition in a Bertrand industry taking this feedback into account. If actual or presumed efficiencies are below the critical levels, the Bertrand equilibrium prices of both products will rise. Based on Werden’s analysis, one can show that both prices will rise if

$$D_{12}(\bar{P}_2 - \bar{C}_2) + D_{12}D_{21}(\bar{P}_1 - \bar{C}_1) > E\bar{C}_1(1 - D_{12}D_{21}) \quad (3)$$

for Product 1 and likewise for Product 2.³²

Inequality (3) comes from solving two markup equations simultaneously. These calculations require no more information than our simpler condition (1) applied to Products 1 and 2, and need not intimidate economists.³³ Inequality (3) might, therefore, be very suitable for use within the DOJ and the FTC as they exercise their prosecutorial discretion.

However, in those rare cases where mergers are litigated, it may be overly optimistic to expect that inequality (3) would 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.³⁴ 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 net upward pricing pressure, but the complexities of full equilibration may quickly lose transparency. For this reason, we focus on inequality (1), while not excluding the prospect that inequality (3) could be used.

In the symmetric case, inequality (3) becomes

³² In particular, one can compare Werden’s equation (5) on p. 411 with the default efficiency level E .

³³ Inequality (3) does require measuring diversion ratios in both directions. Inequality (1) only requires measuring the diversion ratio resulting from changes in the price of Product 1.

³⁴ At the FTC’s Unilateral Effects Workshop in February 2008, a highly regarded merger litigator mocked our much simpler inequality (1) as overly complex for litigation purposes. But inequality (1) seems no more complex than the HHI calculations commonly used to measure market concentration.

$$\frac{D}{1-D} > E \frac{1-\bar{M}}{\bar{M}}, \quad (4)$$

which is easier to satisfy, but not appreciably more complex, than inequality (2).³⁵

F. Non-Bertrand Pricing Behavior

We derived our basic test, inequality (1), under the assumption of classic, Bertrand price setting behavior. What if the merging firms and their rivals do not behave according to static Bertrand competition? For instance, suppose these firms typically respond to one another's price initiatives.

With general oligopoly behavior, the change in Firm B's profits when Firm A initiates a change in P_1 will involve both a change in the sales of Product 2, X_2 , and a change in its price, P_2 .³⁶

The change in X_1 from a given change in P_1 will also be affected by price responses.

Intuitively, the more pre-merger "accommodation" there is, the smaller is the loss of competition due to the merger, and hence the smaller is the marginal-cost efficiency that will compensate.³⁷

One could try to estimate all these effects, but we suspect that systematically doing so would sacrifice a great deal in simplicity, speed and transparency. Keeping firmly in mind our goal of a simple indicator based in the underlying economics to flag when a horizontal merger seems apt—not sure—to be anticompetitive, we believe at this stage that it is sensible to use the simple inequality (1) even when the industry may not behave in a static Bertrand fashion, but to address the question at the rebuttal stage.³⁸ Using inequality (1) avoids the error of allowing a merger to permanently eliminate competition between the merging firms just because they have temporarily found a way to soften competition through accommodating behavior.³⁹

³⁵ This symmetric case is equivalent to Werden's (1996) equation (6) (our notation differs somewhat from his). Ignoring the feedback effect will lead one most astray where D is relatively high. (For example, with $M = 1/3$, and an assumed 10% cost savings, 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%.) 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 very low so that even taking $D \approx 1$, estimating upward pricing pressure by D times gross margin would be a severe underestimate.

³⁶ In Cournot competition, the sales of Product 2 do not adjust when Firm A changes its output, but the price does change. Farrell and Shapiro (1990) show that the standard formula (1) with a rather artificial diversion ratio of unity captures the cannibalization effect.

³⁷ A contrary intuition is that the impact of Firm A's price cut on Firm B's profits is, by the envelope theorem, not strongly affected by whether or how Firm B responds, while the impact on Firm A's sales is distinctly reduced if a major rival matches the cut. At this stage we do not fully understand the analysis with non-Bertrand conduct and the recommendations in the text are therefore inevitably tentative.

³⁸ Below, in Section 7, we discuss the procedural issue of how far a preliminary screen should be tailored to the specific merger, versus being one-size-fits-all so as to maximize transparency.

³⁹ Similarly, the Guidelines contemplate an adjustment to the market definition process to avoid this policy error.

In taking this position we stress that if the industry is clearly not Bertrand, and if that plainly exculpates the merger, then the firms will readily be able to rebut any presumption, and, foreseeing that, the agencies will presumably not go to court. The substantive question therefore is whether one's concern about a merger for which (1) holds should be assuaged if there is only murky evidence on whether the industry can sensibly be modeled as Bertrand, and/or a lack of clarity on whether using a more precise model of the industry would eliminate the concern.⁴⁰

We thus propose that a merger should be presumed to be anticompetitive if inequality (1) holds, and that arguments to the effect that (1) does not have predictive power in this industry should be considered later, as part of the back-end rebuttal or detailed analysis. We also note that the concentration approach to screening shares the feature, or bug, that it does not capture differences across industries in their pre-merger patterns of pricing dynamics.

G. Measurement Issues

Our test requires that one measure pre-merger gross margins (most obviously by measuring prices and marginal costs), and the diversion ratios between the two products. While this may not be easy or perfect, we stress that these variables must also be measured for so-called Critical Loss analysis, a leading quantitative technique of market definition.⁴¹

1. Measuring Gross Margins

Gross margins are also quantified in at least two other contexts.⁴²

In predatory pricing litigation, Areeda and Turner (1975) 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.⁴³

Meanwhile, a large empirical industrial organization literature treats gross margins (typically at a relatively aggregated level such as the industry) as a dependent variable.⁴⁴ This literature has

⁴⁰ The full problem is of course more complex, because the process of rebuttal or back-end analysis is costly and risky for both sides. Thus we certainly do not claim that errors in the presumption screen that can be corrected later are costless. The goal is to keep it simple, yet have it reasonably robustly linked to the economics.

⁴¹ See recently Farrell and Shapiro (2008) and the references therein.

⁴² Of course, any measurement of marginal cost requires that one use some time frame and increment of output. For our purposes, the time frame will typically correspond to the one used to set prices, and the increment will normally be small, since we are interested in first-order effects near the pre-merger output level.

⁴³ 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 $E = 0.1$. Applying inequality (2), the merger creates net UPP if and only if $D > 0.15$. If marginal cost is instead only \$50, then $M = 0.5$ and the test becomes $D > 0.10$.

⁴⁴ See Schmalensee (1989) and Salinger (1990).

become less fashionable, and one reason is a recognition that gross margins may be hard to measure in academic cross-sectional studies. But firms have an incentive to keep track of their cost functions via managerial accounting tools, for instance to know how far they can profitably cut prices. Such information is seldom available to academic researchers on a systematic basis suitable for cross-sectional study, but is typically available to antitrust agencies and courts.

2. Measuring Diversion Ratios

The diversion ratio is defined as the fraction of sales gained by Product 1 from a small reduction in P_1 that come at the expense of Product 2.⁴⁵ The diversion ratio might be estimated by using econometric methods, or by using evidence generated in the firms' normal course of business. To help make pricing and product repositioning decisions, firms often track diversion ratios to see who they are losing business to, or who they can win business from. Survey data can also illuminate diversion ratios,⁴⁶ as can information about customer switching patterns.

Diversion ratios might also be estimated based on market shares, not necessarily in a "relevant antitrust market." If all products in a "market" that includes Product 2 are about equally close substitutes for Product 1,⁴⁷ and if we know the "aggregate diversion ratio" A , meaning the fraction of sales gained by Product 1 from a small reduction in P_1 that come at the expense of other products in the "market," then we can estimate the diversion ratio D_{12} as $A \frac{s_2}{1 - s_1}$, where s_i is Firm i 's market share. These criteria—that the different products in the market are about equally close substitutes for Product 1, and that one can estimate the aggregate diversion ratio—are quite different from the usual criteria for antitrust market definition, whether under the Guidelines or a broader approach.⁴⁸

In bidding markets, the same analysis applies if we interpret the diversion ratio as the probability that Firm B is the buyer's second choice when Firm A wins.⁴⁹ Agencies and courts often have access to data on how buyers ranked bidders in past bidding events, or at least which firms bid and which won. For example, in the Oracle/PeopleSoft merger, data were available on episodes in which large buyers had solicited bids for HRM and FMS software. Oracle and PeopleSoft

⁴⁵ With continuity, this is the same as the fraction of sales lost by Product 1 from a small increase in P_1 that are captured by Product 2. But it need not be the same as the diversion ratio arising when P_2 changes.

⁴⁶ See for instance UK Competition Commission, August 2008.

⁴⁷ This "equally close" assumption underlies merger simulation using the logit demand system, which assumes that there is no variation in "proximity" among a group of products. See Willig (1991) or Werden and Froeb (2007). The analysis does not require that Product 1 be in the "market."

⁴⁸ In market definition under the Guidelines' hypothetical monopolist test (and in Critical Loss Analysis), the aggregate diversion ratio is related to the gross margin (on the assumption, usually maintained there but not needed in our approach, that the margin is uniform). In the Appendix we explore further how the approach of using shares to proxy diversion ratios works out in that setting.

⁴⁹ On unilateral effects in bidding markets, see Werden and Froeb (2007) and Klemperer (2007).

were often two of the leading bidders, suggesting a substantial diversion ratio. Since gross margins were very high, this merger likely would have generated a positive test result using our methods.

3. Sensitivity Analysis

For clarity we have presented our test in terms of point estimates for the gross margin, the diversion ratio, and the presumed efficiencies. But because the logic of the test 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 parameter 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%. Then one could infer upward pricing pressure if the diversion ratio is clearly more than 20%, and need not develop a precise estimate.⁵⁰

3.Pass-Through: From Pricing Pressure to Competitive Effects

In principle, one would like to estimate the magnitude of any post-merger price changes.⁵¹ In this section we discuss what additional information and analysis this would require. We also explain why we believe that such predictions, while potentially part of the full merger analysis, are too complex to be included in a simple and transparent test suitable for establishing presumptions.⁵² Specifically, we show why it is generally much easier and more robust to predict the *sign* of the price effects of a merger, as our test aims to do, than to predict their *magnitude*.

A. Price Effects Depend Upon Pass-Through Rates

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 $t_2^* = D_{21}(P_1^* - C_1)$ on the divisions which sell Products 1 and 2 and are operated to maximize divisional profits.

⁵⁰ Antitrust analysis of mergers has not always coped well with uncertainty: see Katz and Shelanski (2007).

⁵¹ 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.

⁵² 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 meet at least its initial burden of showing that the proposed merger will harm customers.

Applying Proposition 2 to a merger that generates the default efficiencies, $E\bar{C}_1$ and $E\bar{C}_2$, 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 $t_2^* - E\bar{C}_2$ for Product 2, with no changes in other market participants' cost functions. This observation does not provide a constructive method of calculating post-merger prices, because the t^* themselves depend on post-merger prices. But it shows how we can think of the price effects of a merger as resulting from a cost shift for the merging firms' products, without any change in industry structure.

B. Pass-Through Rates Are Complex and Hard to Estimate

This discussion shows the importance of the rate at which cost increases are passed through into higher prices. Importantly, this is not the pass-through rate for industry-wide uniform cost increases:⁵³ the relevant cost increases apply only to the merging firms' products. Moreover, we are concerned with the oligopoly *equilibrium* pass-through rates: how much do equilibrium prices rise, including equilibration of all price responses?

Pass-through of a single-product cost shock, holding fixed other prices, is complex but well understood. Consider a firm facing demand $X(P)$ with point elasticity $\varepsilon(P) = -\frac{P}{X} \frac{dX}{dP} > 1$.

Assume for simplicity that marginal cost C is constant in the relevant range. Bulow and Pfleiderer (1983) show that the pass-through rate, $R \equiv \frac{dP}{dC}$, is given by

$$R = \frac{\varepsilon}{\varepsilon - 1 + (P/\varepsilon)(d\varepsilon/dP)}.$$

This R is lower, the more the elasticity of demand increases with price. For constant elasticity demand, $R = \frac{\varepsilon}{\varepsilon - 1} > 1$, and at the profit-maximizing price, $R = P/C$. However, there is no reason in general to believe that elasticity is constant in the relevant range. Defining the elasticity of the slope of the demand curve as $\beta \equiv \frac{PX''(P)}{X'(P)}$, the pass-through rate at the profit-maximizing price can be written as

$$R = \frac{1}{2 + \beta M}.$$

For linear demand, $\beta = 0$ and $R = 1/2$. For a convex demand curve (including most non-linear functional forms that economists use), $X''(P) > 0$ so $\beta < 0$ and $R > 1/2$. For a concave demand curve, $X''(P) < 0$ so $\beta > 0$ and $R < 1/2$.

⁵³ Economics has clear and intuitive results about the pass-through of industry-wide cost shocks in perfectly-competitive industries, as developed in the public finance literature.

These formulae imply that even R is inherently difficult to estimate: it depends on the *second* derivative of the demand function, which is typically hard to determine in a simple manner suitable for establishing presumptions. This complexity is unavoidable if one seeks to quantify the price effects of a merger: Proposition 2 tells us that the price effect of the merger is the same as the price effect resulting from cost shocks to the merging firms' products.⁵⁴

But quantifying the equilibrium price effects of cost shocks involves even more complexity: it also requires that one account for pricing responses by rival firms. If the direct effect is a price increase, then with upward sloping reaction schedules in Bertrand oligopoly, rivals increase their prices in an accommodating manner. This implies higher pass-through rates than in the single-firm case, but in a complex way that depends on oligopoly behavior and the whole demand system. And these effects matter a lot. Froeb et al. (2005) simulated the effects of the proposed MCI-Sprint merger using different demand systems, and found that the estimated effect using constant-elasticity demand was over seven times greater than that using linear demand.

Estimating equilibrium pass-through rates of asymmetric shocks using historical data might be possible in those happy circumstances where cost shocks applying just to the merging firms (possibly including previous mergers) have taken place and their price effects can be observed.⁵⁵ But in our experience these circumstances are relatively rare, plus it is not clear that R_1 is constant. As Froeb et al. (2005) observe, because demand curvature is difficult to estimate, it is almost always *assumed* via the choice of functional form for the demand system.⁵⁶ This modeling choice imposes a link between estimated point elasticity and estimated curvature.

Because the magnitude of predicted price effects 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 a presumption of harm to competition on the magnitude of the cannibalization term, leaving the difficult and problematic debate about pass-through rates to later investigation, if ever.

C. Test Based on a “Significant” Price Increase

Under current practice, before considering efficiencies at all one asks whether the proposed merger, *without efficiencies*, would lead to a “significant” price increase, such as at least a fraction G of the pre-merger price. This might seem a natural method of “raising the bar” for the government to establish a presumption that the merger is anti-competitive. Raising the bar

⁵⁴ The idea that the price effect resulting when a group of competing firms set their prices to maximize joint profits can be evaluated as the pass-through of a cannibalization term can also be applied to the hypothetical monopolist in the *Guidelines* for the purpose of market definition. See Farrell and Shapiro (2009).

⁵⁵ Baker and Bresnahan (1988) rely on such idiosyncratic cost changes to estimate a firm's residual demand curve.

⁵⁶ Commenting on merger simulation, Froeb et al. (2005) observe that the estimated pass-through of merger efficiencies depends on the choice of demand system (and show that this dependence can matter quite dramatically), 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). Our Proposition 2 explains this observation, by noting that competitive effects are the pass-through of the cannibalization terms.

might be desirable depending upon the incidence of false positive vs. false-negative test results and the social costs of such errors.⁵⁷ It might be desirable also if a permissive merger environment has benefits beyond this specific merger, for instance by sustaining a lively corporate-control threat to complacent managements. However, as we see next, raising the bar via G creates some problems and if one thinks (for instance) that false positives result from under-estimation of efficiencies, it might be better simply to adjust E .⁵⁸

Since current practice—somewhat loosely interpreted—offers the leeway parameterized by G and by E only as alternatives, a criterion that offers them in conjunction will be more lenient than current practice on average if it uses the same values or ranges as current practice.

Internalizing the cannibalization effect on Product 1 measured at pre-merger prices and costs would lead to a “significant” increase in the price of Product 1 if $R_1 \bar{t}_1 > G \bar{P}_1$, where R_1 is the equilibrium pass-through rate for cost shocks idiosyncratic to Product 1. Recalling that $\bar{t}_1 = D_{12}(\bar{P}_2 - \bar{C}_2)$, this test asks whether $R_1 D_{12}(\bar{P}_2 - \bar{C}_2) > G \bar{P}_1$, i.e., whether

$$D_{12} \frac{\bar{P}_2 - \bar{C}_2}{\bar{P}_2} \frac{\bar{P}_2}{\bar{P}_1} > \frac{G}{R_1}. \quad (5)$$

Combining (5) with explicit allowance for marginal-cost efficiencies yields the condition for the *net* pricing pressure to induce a “significant” price increase: $R_1 [D_{12}(\bar{P}_2 - \bar{C}_2) - E \bar{C}_1] > G \bar{P}_1$, or

$$D_{12} \bar{M}_2 \frac{\bar{P}_2}{\bar{P}_1} - E_1(1 - \bar{M}_1) > \frac{G}{R_1}. \quad (6)$$

This is inequality (1) with $\frac{G}{R_1}$ added to the right-hand side. One could dub the left-hand side the “net upward pricing pressure index” or NUPPI. Inequality (6) then flags the merger as plausibly anticompetitive if the NUPPI exceeds $\frac{G}{R_1}$. But, as we argued above, R_1 is hard to estimate for a given merger, and thus in a practical preliminary screen it may need to be proxied by a default value such as $R_1 = 0.5$.⁵⁹ In the symmetric case, inequality (6) can be replaced by:

⁵⁷ Because a false positive is rebuttable, while a false negative probably allows an anticompetitive merger to be consummated, one might argue that the danger of false negatives is greater.

⁵⁸ Some might benchmark G at 5% or 10% via the *Guidelines*' use of the term “small but significant and non-transitory increase in price” (“SSNIP”) in market definition; the SSNIP is usually taken to be 5% or 10%. However, the *Guidelines* (§1.0) stress that “The ‘small but significant and non-transitory’ increase in price is employed solely as a methodological tool for the analysis of mergers: it is not a tolerance level for price increases.”

⁵⁹ With linear demand, the single-firm pass-through rate is $\frac{1}{2}$, and with accommodating pricing responses by rivals the equilibrium pass-through rate is higher. Some may find this an adequate justification in practice for taking $\frac{1}{2}$ as a default value, pending further investigation.

$$D\bar{M} - E(1 - \bar{M}) > \frac{G}{R}$$

where R is now the pass-through rate for cost increases applying to both products.

To illustrate how this might work, suppose that a “significant” price increase is taken to be 5%, so $G = .05$. Then, with $R = 1/2$, a merger would be presumed to raise price if NUPPI is at least 10%. If we use $E = 0.1$, in the symmetric case NUPPI becomes $(D + 0.1)\bar{M} - 0.1$, so NUPPI is at least 10% if $(D + 0.1)\bar{M} > 0.2$. With $M = 0.4$, NUPPI would exceed 10% if $D > .40$. With $M = 1/2$, NUPPI would exceed 10% if $D > .30$.

Clearly, using inequality (6) with $G > 0$ is more permissive than using (1), especially if a low pass-through rate R_1 is used. Like (1), it illuminates the fact that unilateral concerns are strongest not only when the diversion ratio is high but also when gross margins are high.

Inequality (6) also illuminates the highly roundabout way in which efficiencies enter current practice under the Guidelines.⁶⁰ One first asks whether the merger, without any efficiencies, would lead to a “significant” loss of competition—which we broadly translate into “significant price increase.” This is akin to evaluating inequality (6) with E_1 temporarily set to zero, i.e., using inequality (5). As we have stressed, this requires one to form a (usually implicit) view on R_1 . If (6) holds with E_1 temporarily set to zero, one *then* asks whether the likely efficiencies outweigh the gross upward pricing pressure.⁶¹ This involves evaluating inequality (6) with G now set equal to zero, i.e., using inequality (1).

D. Could the Price Effects Be Small Despite UPP?

While the pass-through rate may be hard to quantify, one might hope to identify circumstances in which it is low. In particular, a leading intuitive argument is the idea that if “the market is competitive” firms cannot profitably pass through idiosyncratic cost increases. This would seem to fit with the rule of thumb that a horizontal merger that leaves the industry workably competitive is unlikely to be harmful. Does our test capture this view, and is the view accurate? The answer depends in part on what one means by calling an industry workably competitive.

One diagnostic for an industry to be workably competitive would be that pre-merger gross margins are low. Another diagnostic would be that the industry is unconcentrated and the

⁶⁰ The section of the Guidelines dealing with efficiencies is brief and was added only in 1997.

⁶¹ Under the Guidelines, this stage uses merger-specific efficiencies credibly documented for this particular merger, rather than a standard deduction. Thus the default role of the standard deduction is arguably played more by G than by E .

merging parties are not especially close competitors. In either case, our test will see that the product of the diversion ratio and absolute gross margin is low, and will not sound the alarm.⁶²

For a merger with substantial diversion ratios in an industry where gross margins are not so small (perhaps because there are large fixed costs), the predicted price effect can be small only if the relevant pass-through rate is low. A natural economic intuition suggests that the equilibrium pass-through of cost shocks idiosyncratic to one or two firms in a “fairly competitive” industry will be low. Bergstrom and Varian (1985) show that in a Cournot oligopoly with N active firms and linear demand the equilibrium pass-through rate of firm-specific cost shocks is $1/(N+1)$.⁶³

In a differentiated-products industry, as discussed above, a firm can face a highly elastic (residual) demand curve, and yet have a high pass-through rate. Indeed, if a firm’s residual demand is everywhere highly elastic, then its price will be close to its marginal cost, both before and after a change in the latter, so pass-through of a substantial idiosyncratic cost shock will be close to 100%. As noted above, if the firm faces a constant elasticity of demand, its firm-specific pass-through rate will equal $P/C = 1/(1-M)$, which exceeds 100%.

However, the concept of a “fairly competitive” industry may not be fully captured by residual demand elasticities, especially in an industry that somehow seems “competitive” despite substantial gross margins. There may be something about such industries that ensures low pass-through rates, but it is not as transparent from economic theory as is sometimes suggested.⁶⁴

Empirically, while the pass-through of industry-wide cost shocks (notably commodity taxes) has been studied extensively in public finance,⁶⁵ the pass-through of cost shocks that apply to only some competing products has been studied primarily in the international trade literature.⁶⁶ When (for instance) the yen appreciates relative to the dollar, how do dollar prices of Japanese cars in the US respond? The literature generally finds that such a change in the dollar-denominated marginal costs of Toyotas and Nissans is substantially, though not fully, proportionally reflected in their US prices, but also that the extent to which this is true is highly variable.

In our present state of understanding we thus think it is appropriate for a preliminary screen to flag as presumably problematic a horizontal merger with a hefty cannibalization term \bar{t}_1 , even

⁶² Indeed, this is a possible source of false negatives: if Firms A and B compete so hard pre-merger that their gross margins are near zero, then our test will not flag a problem even if each is the other’s only significant competitor at pre-merger prices.

⁶³ Linear demand brings this principle into closed form, but a version of it applies for any demand function. Adding the firms’ first-order conditions and rearranging yields $P(1-1/(N\varepsilon)) = \bar{C}$, where ε is market demand elasticity and \bar{C} is the (unweighted) mean value of marginal costs among active firms.

⁶⁴ We particularly thank Glen Weyl for helpful discussions on this topic (though he does not necessarily agree with our interpretations).

⁶⁵ But see Ashenfelter et al. (2006) on pass-through in the Staples case, *FTC v. Staples*, 970 F. Supp 1066 (1997).

⁶⁶ Goldberg and Knetter (1997) report finding almost 700 articles on this topic. An important early contribution is Dornbusch (1987)

when the broad industry is arguably “fairly competitive” and a full analysis (including investigation of pass-through) may exculpate it. This is just like the established practice of flagging concentrating mergers in highly concentrated industries but standing ready to let them through if the parties adduce (in the language of *Philadelphia National Bank*) “evidence clearly showing that the merger is not likely to have such anticompetitive effects.” Under our simple and clean test (1), the magnitude of the predicted effect is not relevant, but if a mixed test such as (6) is used, it would be open to merging firms to show that R_1 is small.

4. Rebuttal of the Presumption

Real-world mergers are complex, and the merging parties should be able to rebut any presumption based on a simple test. The strength of any presumption should depend upon how meaningful and powerful the test results are judged to be in the case at hand. If net upward pricing pressure has been demonstrated, there are a number of routes that the merging firms can take to rebut a presumption of harm.⁶⁷

A. Challenge to Estimated Variables in the UPP Test

Firms might show that, contrary to the government’s calculations, the test correctly applied does not identify net UPP. For example, they might show that the pre-merger marginal costs are higher (and thus closer to prices) than the government had claimed. Alternatively they might show that likely efficiencies are much higher than the standard deduction.⁶⁸

B. Pressure But No Significant Movement

As discussed above, merging firms might argue that, even with net upward pricing pressure, there will be no “significant” price increase because the relevant pass-through rates are low. This is irrelevant under our pure test.⁶⁹

C. 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

⁶⁷ We are describing here a rebuttal process if the case is litigated in court. Of course we anticipate that the agencies would study these issues before suing to block a proposed merger, so these may be out-of-equilibrium rebuttals.

⁶⁸ An interesting procedural question is whether the government should have an opportunity to argue that the merger will not generate even standard-deduction efficiencies, or (very similarly) whether the efficiencies presumed at the screening stage must be shown to be credible and merger-specific at the later, more detailed stage.

⁶⁹ Stepping back from the consumer-surplus standard towards a total-surplus standard, one can note that if mergers are motivated by increases in profit, 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 Ordover 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).

net UPP for one product and not for the other, as for instance if inequality (1) holds for Product 1 (say) but not for Product 2. We nevertheless tentatively propose that a positive test result for any (significant) product should be enough to establish the rebuttable presumption. Obviously this implies that one strand of rebuttal from mixed UPP test results would be to argue that there will be no price increase on either product.

Another strand of rebuttal would argue that a price decrease on Product 2 will outweigh (from a consumer surplus standpoint) any price increase on Product 1.⁷⁰ 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 it may be fruitful to explore 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 likely rise or fall. If this approach is taken, it will be important that the efficiencies used reasonably reflect the likely efficiencies for the two products.

D. Full Analysis of Competitive Effects

In the end, any merger case may come down in the end to the most complete feasible analysis of competitive effects. As under current practice, this back-end analysis could consider product repositioning, entry, and efficiencies, as in Sections 3 and 4 of the Guidelines.

5. Comparison with Merger Simulation

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.⁷¹ 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.⁷²

⁷⁰ This is presumably what is (explicitly or implicitly) argued when the plan of the merger is to shut down Product 1, as in Whole Foods or Oracle.

⁷¹ Another alternative is to exploit “natural experiments” in which we can observe market outcomes with and without competition between the merging parties. This could make it unnecessary to engage separately in market definition or other preliminary diagnostics, including ours. The Staples case is often cited as a prime example of this approach, although in that case the FTC still built its case by defining a relevant antitrust market.

⁷² For a recent survey of the use of merger simulation in litigation, see e.g. Budzinski and Ruhmer (2008).

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.⁷³ 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.

6. Comparison with Market Definition

We have emphasized that our approach does not require estimating the pass-through rate. In this respect, our approach is simpler than the market definition methodology in the Guidelines. Like merger simulation, the "hypothetical monopolist test" in the Guidelines hinges on pass-through rates, although this fact is not generally appreciated. Indeed, Guidelines market definition is closely related to the simulation of a hypothetical merger that combines all of the products in a proposed relevant market within a single firm.⁷⁴

What should one make of situations in which our test indicates UPP but the merger does not lead to a significant increase in concentration in what appears to be the relevant market? One answer is that there may well be a narrower relevant market, using the methodology of the Guidelines, in which the merger would lead to a large increase in concentration. For instance, in *Whole Foods*, if the gross margins were moderate and the diversion ratio between Whole Foods and Wild Oats was large, then the FTC's narrow market definition was likely legitimate under the Guidelines. But the *Whole Foods* case itself illustrates that the courts can be uncomfortable with the relatively narrow markets implied by the Guidelines, preferring broader markets that include all "reasonable substitutes." In practice, courts find something peculiar about excluding from the relevant market products that clearly offer some meaningful competition for those of the merging firms. This problem is most severe when the merging firms offer very close substitutes but there is no clear gap in the chain of substitutes.

Our approach could be implemented without requiring that the courts abandon the use of market definition, and without requiring that the courts embrace the narrower relevant markets implied by the Guidelines. The government could define the relevant product market relatively broadly; this might correspond to a product market consisting of all supermarkets in the *Whole Foods*

⁷³ 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.

⁷⁴ Like merger simulation, market definition, as performed in practice using critical loss analysis, often fails to focus on the *change* in pricing incentives. By instead attempting to model the pricing incentives of a hypothetical monopolist 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 would have an incentive to lower the price below pre-merger levels, a glaring problem with the methodology. Werden (2008) calls this "Critical Loss Analysis by Defendants."

case. Within that market, the government could obtain its presumption by applying the pure version of our test, inequality (3), i.e., by asking whether the merger will create upward pricing pressure. If the modified version of our test reflected in inequality (6) is to be used, the government could obtain its presumption by showing that the net upward pricing pressure index, NUPPI, exceeds some threshold. The relevant product market would provide the context in which the merger would be analyzed, especially for any back-end analysis.

The government might need to explain to the court how the merger would lead to price increases for the products sold by the merging firms, even though their market shares in the relevant market are modest. This response might simply rely on the relatively low market concentration thresholds found in the Guidelines (§1.51(c)): “Where the post-merger HHI exceeds 1800, it will be presumed that mergers producing an increase in the HHI of more than 100 points are likely to create or enhance market power or facilitate its exercise.” For instance, a seven to six merger in a symmetric industry would raise the HHI from 1429 to 1837. True, it might well startle today’s antitrust community if the agencies actually challenged a symmetric seven-to-six merger.⁷⁵ In part, the low enforcement rate for mergers in this range reflects the fact that any structural presumption may be overcome by other factors. But it also reflects the relatively narrow relevant markets under the Guidelines. Modest increases in concentration in those markets are less likely to harm competition than are comparable increases in broader markets.

In cases where there is UPP but the market shares of the merging firms in the broad market are too low to establish any structural presumption, the government would need to explain how the merger would lead to the loss of important, localized competition between the two merging firms. Diversion ratios would undoubtedly be central to this explanation. The government might also need to clarify that the price increases resulting from the merger would not apply uniformly to the entire relevant market. And, of course, the merging parties could rebut the government’s case by showing, for example, that firms in the broader market could rapidly reposition their products, deterring or offsetting any localized post-merger price increases.

Many of these ideas relating to localized competition could be expressed in market-definition language using the concept of a “submarket.” In the *Whole Foods* case, this would correspond to a submarket of premium natural and organic supermarkets, within the larger competitive space of all supermarkets. Indeed, the Court of Appeals in *Whole Foods* seemed to revive the notion of submarkets, which had fallen out of favor. It remains to be seen whether the use of submarkets

⁷⁵ The FTC reports that between 1996 and 2005 it investigated 37 mergers for which the post-merger HHI was between 1800 and 2400 and the change in HHI was between 100 and 300, of which it took an enforcement action for only 18. See Table 3.1 from “Horizontal Merger Enforcement Data: Fiscal Years 1996-2005,” available at <http://www.ftc.gov/os/2007/01/P035603horizmergerinvestigationdata1996-2005.pdf>. The FTC’s universe was 188 mergers for which a second request was issued under a horizontal theory of harm to competition. As shown in Table 2, these mergers involved 976 total relevant markets. This study therefore omits mergers that involved significant increases in concentration but for which no second request was issued. Table 4.1 slices the data based on the FTC’s assessment of the number of significant competitors rather than the HHI. These numbers almost certainly overstate recent merger enforcement, since they only report on merger cases assigned to the FTC and merger enforcement at the DOJ has been significant more lax than at the FTC in recent years; see Baker and Shapiro (2008). Of course, as our discussion stresses and as antitrust practitioners are well aware, such statistics depend heavily on the market definition used, and the FTC’s market definition was simply asserted in most of these 37 mergers.

by the *Whole Foods* court will revive this concept or come to be seen as a peculiar throwback to the 1960s. If the submarket concept is revived, this could afford the government a way to establish the structural presumption in a Guidelines market, i.e., in a *submarket*, even in cases where the court is unwilling to define the relevant *market* so narrowly, perhaps because it concludes that a broader group of products must be considered in the overall analysis. Carefully used, the revival of submarkets could thus be a positive step. However, the market definition exercise would still be roundabout in comparison with our approach, it would still depend upon the pass-through rate, and it would still fundamentally be a line-drawing exercise based on poorly-justified parameters such as the HHI thresholds and the size of the SSNIP.

7. Tailoring and Transparency

We have put forward a simple test to flag horizontal mergers that, based on fundamental economics, *seem likely* to raise prices or similarly harm competition. As discussed above, we envision that if the simple screen goes awry, the merging parties (or, in the case of false negatives, the government) should be able to show this by detailed analysis of the merger’s likely effects (as they can now with the screen based on concentration). Even so, errors in the screen may be socially costly. Should the screen itself seek to incorporate more of the possible complexities that will certainly arise in the detailed back-end analysis?

This is a question of judgment more than of economic analysis as such. Our antitrust experience suggests to us that a simple and transparent screen, combined with the prospect of more detailed analysis later in the process, is probably more realistic than trying to anticipate many of the nuances at the screening stage.

As an example, one can ask how the test should be modified if the merging firms control multiple products prior to the merger. If Firm A owns just Product 1 while Firm B owns Products 2, ..., n ,⁷⁶ the cannibalization term should be:

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

This shows how one could 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. Accounting for such factors at the screening stage seems practical and relatively straightforward.

⁷⁶ 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 in this paper.

But how should one handle situations in which Firm B also sells products that are complementary to Product 1? 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 true UPP. In principle, the effect of Product 3 could be included in the initial test, or it could be deferred to the back-end. In the latter case, accounting for this effect could directly rebut the government's claim that the merger will lead to UPP.

Of course, the government would anticipate this; if the rebuttal was clear and convincing, the government might conclude that the merger would not raise prices (or not be enjoined by a court) and not challenge it.

A closely related issue arises 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, $\bar{P}_2 - \bar{C}_2$. Conceptually, such future benefits add to Product 2's gross margin. These additional margins may be quite concrete, as with subsequent sales of spare parts or other complements, or less tangible: in markets with network effects, learning by doing, or customer switching costs, additional sales today will generate additional revenues in the future. Follow-on revenues are sometimes illuminated in the firms' business documents. For example, firms may have methods of valuing their installed base of customers, either to justify the goodwill on their balance sheets or to evaluate the profitability of customer acquisition.⁷⁷ Even if follow-on revenues cannot be measured, we may at least know their sign, treat the "hard" profit accounting as a bound, and keep track of the direction of error.⁷⁸ Since firms usually benefit in the future from making more sales today, we expect that in most cases accounting for these effects will raise the margin on Product 2, making UPP for Product 1 more likely.

8. Conclusion

We have put forward a simple diagnostic test to flag 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

⁷⁷ 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: see Edlin and Farrell (2002).

⁷⁸ This issue also arises when measuring gross margins in Critical Loss analysis; see Farrell and Shapiro (2008).

approach.⁷⁹ It is much more solidly grounded in the underlying economics of unilateral effects than the market definition/concentration approach.

While we believe our analysis is original and our proposed test is a significant departure from the *Guidelines*, it is also not so new: it recognizes and systematizes what we believe is an instinct shared by many industrial organization economists, including some at the agencies, that there is a robust core behind the regrettably labile predictions of structural merger simulation, and that this core deserves to emerge from behind the curtains for use in unilateral-effects cases. At the FTC Workshop on Unilateral Effects earlier this year, several former government officials indicated that the agencies often look for evidence of competitive effects, somewhat along the lines of our test, and then “back out” a market definition as necessary for litigation.⁸⁰ This suggests that, in such cases, the market definition exercise is a distracting appendage to the “real” analysis of mergers with unilateral effects. And if the agencies are not consistently following their own *Guidelines*, transparency and honesty call for a revision.

⁷⁹ 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 the latter is to compare the observed changes from completed mergers against pre-merger predictions. Regrettably, retrospective studies of merger effects have been scarce and limited, and have seldom compared observed effects with *ex ante* predictions, although see Peters (2006) and Weinberg and Hosken (2008). Dennis Carlton (2007) recently called for just this type of empirical research program. See Pautler (2003), Kaplow and Shapiro (2007), and Weinberg (2007) on merger retrospectives more generally.

⁸⁰ A similar approach has been used in recent years in UK competition policy. See, for example, the U.K. Competition Commission (2005).

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Appendix

Proof of Proposition 1

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

$D_{12} \frac{\bar{P}_2 - \bar{C}_2}{\bar{P}_2} \frac{\bar{P}_2}{\bar{P}_1} \frac{\bar{P}_1}{\bar{C}_1} > E$. 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 for

Product 1 can be written as $\frac{D_{12}\bar{M}_2(\bar{P}_2 / \bar{P}_2)}{1 - \bar{M}_1} > E$. 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

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

We make the very mild assumption that the equilibrium price of each product is non-decreasing in the marginal cost of each product, and that a given product's equilibrium price is strictly increasing in that product's marginal cost. As just shown, with UPP for both products, the cost reductions necessary for prices to remain unchanged are strictly greater than the default cost reductions. Applying our monotonicity assumption, a merger generating the default cost reductions will lead to strictly higher prices for both products.

Proof of Proposition 2

The specified 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.

Relationship between Shares and Upward Pricing Pressure

One could imagine that, although it would be imprecise, the approach taken in the Guidelines could provide a proxy for the approach based on margins and diversion ratios. The breadth of the relevant market under the Guidelines is related to pre-merger gross margins, and market shares within that market might reasonably be linked to relative diversion ratios. Here we offer a preliminary exploration of this question.

If prices and gross margins are the same for all products in a candidate market, it exactly meets the breakeven-SSNIP requirement if, in response to a 1% increase in the price of one such product, say Product 1, $\frac{1}{M+S}$ percent of its demand would be lost to products outside the

market, where S is the size of the SSNIP. From the Lerner Equation, we can assume that $\frac{1}{M}$

percent of Product 1's demand would be lost to it, so the difference, or $\frac{S}{M(M+S)}$ percent, is

“diverted” within the candidate market. The aggregate diversion ratio within the market is then

equal to that expression as a fraction of the total lost demand, or $\left[\frac{S}{M(M+S)} \right] / \left[\frac{1}{M} \right] = \frac{S}{M+S}$.

If Product 1 has a market share equal to Z_1 and Product 2 has a share of Z_2 , then if we ignore—as a market-share approach must—differences in proximity among products in the market, the proxy estimate of the fraction of that aggregate diversion ratio that goes to Product 2 would be

$\frac{Z_2}{1-Z_1}$. Thus we have $D_{12} = \frac{Z_2}{1-Z_1} \frac{S}{M+S}$. Applying equation (1) with that proxy for the

diversion ratio, our diagnostic compares $\frac{Z_2}{1-Z_1} \frac{S}{M+S} \frac{M}{1-M}$ against the proportional

efficiencies, E . One could explore whether there are important circumstances in which this roughly aligns with the Guidelines' concentration and increase-in-concentration thresholds, but it is not evident that there are. For example, the distribution of sales among the non-merging firms in the relevant market does not enter into our diagnostic test but does affect the pre-merger HHI.