# Incentive Scoring in Merger Review

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Abstract

The traditional legal approach to merger analysis treats on concentration and market shares as a preliminary screen. However, concentration and market shares are not linked directly to the merging parties' post-merger incentives to engage in the potentially problematical conduct. Economists have formulated methodologies to score the competitive impact of mergers with screening measures more directly related to the incentives of the parties. We refer to this general approach as "incentive scoring." Incentive scoring makes economic sense because antitrust analysis is premised on the assumption that firms are rational, profit-maximizing entities. While incentive scoring is not the only information relevant for evaluating likely competitive effects, it clearly is useful evidence, especially in the early phases of a merger investigation. In this paper, we review several related upward pricing pressure measures, the GUPPI for unilateral effects in horizontal mergers, the cGUPPI for coordination issues in horizontal mergers and the vGUPPI for input foreclosure and pricing in vertical mergers.

## I.  Introduction

Mergers power can raise concerns of potential anticompetitive effects. These competitive concerns depend on whether the merger is horizontal or vertical. For horizontal mergers, the competitive concerns generally focus on unilateral and coordinated effects. For vertical mergers, the competitive concerns can involve exclusion (foreclosure) or coordination. The exclusion concerns can involve either input foreclosure or customer foreclosure.

The traditional legal approach to merger analysis treats on concentration and market shares as a preliminary screen. However, concentration and market shares are not linked directly to the merging parties' post-merger incentives to engage in the potentially problematical conduct. For example, the increase in the HHI generally does not relate directly to the change in unilateral incentives caused by a horizontal merger. As a matter of economic analysis, those

concentration indices are particularly relevant for some type of conduct but not others. Market shares and concentration similarly do not relate directly to foreclosure incentives resulting from a vertical merger.

In recent years, economists have formulated methodologies to score the competitive impact of mergers with screening measures more directly related to the incentives of the parties. Initial efforts involved defining the relevant antitrust market and resulted in a more accurate "hypothetical monopolist test" for market definition that scores the incentives of a hypothetical monopolist (or hypothetical cartel) to raise prices.[1] The 2010 U.S. Horizontal Merger Guidelines (hereinafter, "Guidelines") took this approach a step further by adopting a gross upward pricing pressure index ("GUPPI") for scoring the unilateral incentives of merging parties to raise price post-merger.[2] A variant of the GUPPI also can be applied to partial

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[1] *See* Michael Katz and Carl Shapiro, "Critical Loss: Let's Tell the Whole Story," 17 *Antitrust* 49 (2003); Daniel O'Brien and Abraham Wickelgren, "A Critical Analysis of Critical Loss Analysis," 71 *Antitrust Law Journal* 161 (2003). *See also* Øystein Daljord, Lars Sørgard and Øyvind Thomassen, "The SSNIP Test and Market Definition with the Aggregate Diversion Ratio: A Reply to Katz and Shapiro," 4 *Journal of Competition Law and Economics* 263 (2008); Joseph Farrell and Carl Shapiro, "Improving Critical Loss Analysis," *Antitrust Source* (Feb. 2008); Serge X. Moresi, Steven C. Salop and John R. Woodbury, "Implementing the Hypothetical Monopolist SSNIP Test With Multi-Product Firms," *Antitrust Source* (Feb. 2008). *See also* U.S. Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines (Issued August 19, 2010) at note 4, *available at* http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf.

[2] *Guidelines* §6.1. The GUPPI methodology is based on the Bertrand model of price competition among firms selling differentiated products. This methodology can be extended to markets where firms compete in quantities or capacity instead of price, bidding markets, and markets with congestion issues. *See* Serge Moresi, *The Use of Upward Price Pressure Indices in Merger Analysis*, ANTITRUST SOURCE, Feb. 2010; Robert Willig, *Unilateral Competitive Effects of Mergers: Upward Pricing Pressure, Product Quality, and Other Extensions*, 39 REV. INDUS. ORG.19 (2011).

ownership acquisitions, including those that give the acquiring firm some degree of control over the acquired firm.[3]

We refer to this general approach as "incentive scoring." Incentive scoring methodologies are particularly useful when compared to simple structural measures such as the HHI or other concentration indices. Incentive scoring makes economic sense because antitrust analysis is premised on the assumption that firms are rational, profit-maximizing entities. Thus, the economic incentives of the firms provide relevant information about the likely outcomes of their combinations. While incentive scoring is not the only information relevant for evaluating likely competitive effects, it clearly is useful evidence, especially in the early phases of a merger investigation. For example, GUPPIs provide a quantitative indication of the potential unilateral effects of a merger without the attempt to implement a full-blown merger simulation model.

In this paper, we discuss the several types of indices for scoring incentives. We begin by reviewing the use of the GUPPI for scoring the unilateral incentives to raise prices in horizontal mergers and partial equity acquisitions.[4] The basic GUPPI methodology for scoring incentives has been applied to a broad range of mergers, including the acquisition of partial ownership interests, and to different types of markets, such as bidding markets and Cournot markets.[5]

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[3] Daniel P. O'Brien & Steven C. Salop, *Competitive Effects of Partial Ownership: Financial Interest and Corporate Control*, 67 ANTITRUST L.J. 559 (2000).

[4] For a formal definition of unilateral effects and a discussion of examples from the United States and Europe, *see* Gregory J. Werden & Luke M. Froeb, *Unilateral Competitive Effects of Horizontal Mergers*, in HANDBOOK ANTITRUST ECON. 43 (Paolo Buccirossi, ed., 2007). For a discussion of coordinated effects and parallel accommodating conduct, *see* Joseph E. Harrington, *Evaluating Mergers for Coordinated Effects and the Role of "Parallel Accommodating Conduct"*, 78 Antitrust L.J. 651 (2013).

[5] Robert Willig, *Unilateral Competitive Effects of Mergers: Upward Pricing Pressure, Product Quality, and Other Extensions*, 39 REV. INDUS. ORG.19 (2011); Serge Moresi, *The Use of Upward Price Pressure Indices in Merger Analysis*, ANTITRUST SOURCE, Feb. 2010.

We then review our recent work on developing several two other incentive scoring methodologies. We have developed vertical GUPPIs (vGUPPI) for scoring the incentives for input foreclosure in vertical mergers.[6] We also have developed a coordination GUPPI (cGUPPI) for scoring concerns about parallel accommodating coordinated conduct in horizontal mergers.

We want to emphasize that these examples are not the only potential incentive scoring methodologies. Our work is part of a larger project to design a menu of incentive scoring methodologies for evaluating various competitive concerns raised in merger policy. For example, Bernheim and Whinston[7] have scord the incentives for collusion versus defection using the critical discount rate. Kovacic, Marshal, Marx and Schulenberg[8] have scored the incentives for collusion by evaluating the benefits of collusion. The vertical arithmetic methodology[9] also is used to evaluate foreclosure concerns in vertical mergers and for other alleged exclusionary conduct.

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[6] For a discussion of input foreclosure in the context of vertical mergers, *see* Michael H. Riordan & Steven C. Salop, *Evaluating Vertical Mergers: A Post-Chicago Approach*, 63 ANTITRUST L.J. 513 (1995).

[7] B. Douglas Bernheim and Michael D. Whinston, *Multimarket Contact and Collusive Behavior, 21 RAND J. ECON 1 (*1990).

[8] Robert Marshall, William E. Kovacic, Leslie M. Marx, Steven P. Schulenberg, *Coordinated Effects in Merger Review: Quantifying the Payoffs from Collusion*, in B. Hawk (ed.), INTERNATIONAL ANTITRUST LAW & POLICY: FORDHAM CORPORATE LAW (2006).

[9] For example, *see* David Sibley & Michael J. Doane, *Raising the Costs of Unintegrated Rivals: An Analysis of Barnes & Noble's Proposed Acquisition of Ingram Book Company*, *in* MEASURING MARKET POWER 211 (Daniel J. Slottje ed., 2002); Jonathan B. Baker, *Comcast/NBCU: The FCC Provides a Roadmap for Vertical Merger Analysis*, ANTITRUST, Spring 2011, at 36; Daniel Rubinfeld, *The Primestar Acquisition of the News Corp./MCI Direct Broadcast Satellite Assets*, 16 REV. INDUS. ORG. 193 (2000); Steven C. Salop, Carl Shapiro, David Majerus, Serge Moresi & E. Jane Murdoch, Charles River Assocs., *News Corporation's Partial Acquisition of DIRECTV: Economic Analysis of Vertical Foreclsures Claims* (FCC Submission July 1, 2003) [hereinafter Salop et al., *DIRECTV*], *available at* http://apps.fcc.gov/ecfs/document/view.action?id=6514283359; Steven C. Salop, Stanley M. Besen, John R. Woodbury & E. Jane Murdoch, *An Economic Analysis of Primestar's Competitive Behavior and Incentives* (FCC Submission Jan. 7, 1998) (on file with authors).

These incentive scoring methodologies all are premised on the assumption that firms are rational, profit-maximizing entities, an assumption that remains at the core of antitrust.[10] Thus, the economic incentives of the firms provide relevant information about the likely outcomes of combinations. While incentive scoring is not the only information relevant for evaluating likely effects, it clearly is useful evidence. As a result, the breadth of incentive scoring methodologies is likely to grow over time.

The remainder of this article is organized as follows. Section II analyzes the horizontal GUPPIs used to score unilateral incentives in horizontal mergers. Section III analyzes the vertical GUPPIs used to score input foreclosure and pricing incentives in horizontal mergers. Section IV analyzes the coordination GUPPI used to score incentives for parallel accommodating conduct in horizontal mergers. Section V concludes.

## II.    Horizontal GUPPIs

The incentive scoring methodology discussed in this paper is rooted in the extensive economic literature on the unilateral effects of horizontal mergers.[11] The U.S. Horizontal Merger

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[10] For example, *see* 1 PHILLIP E. AREEDA & HERBERT J. HOVENKAMP, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION ¶ 113, at 137 (2d ed. 2000). This assumption has recently been challenged in several articles. For example, *see* Amanda P. Reeves & Maurice E. Stucke, *Behavioral Antitrust*, 86 IND. L.J. 1527 (2011); William Rinner and Avishalom Tor, *Behavioral Antitrust: A New Approach to the Rule of Reason after* Leegin, 2011 UNIVERSITY OF ILLINOIS LAW REVIEW 805 (2011). For one recent critique of the use of behavioral economics in antitrust, *see* Judd E. Stone and Joshua D. Wright, *Misbehavioral Economics: The Case Against Behavioral Antitrust,* 33 Cardozo Law Review1517 (2012).

[11] For a sampling of articles developing techniques for gauging unilateral effects, *see* Robert B. Willig, *Merger Analysis. Industrial Organization Theory and Merger Guidelines*, BROOKINGS PAPERS ECON. ACTIVITY: MICROECONOMICS 281 (1991); Gregory J. Werden & Luke M. Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy*, 10 J.L. ECON. & ORG. 407 (1994); Jerry A. Hausman, Gregory K. Leonard & J. Douglas Zona, *Competitive Analysis with Differentiated Products*, 34 ANNALES

Guidelines first incorporated unilateral effects analysis in 1992.[12]  It has long been recognized that the HHI has shortcomings as an analytic tool for evaluating unilateral price effects concerns in markets with differentiated products.[13]  This is because unilateral effects analysis focuses first on the competitive incentives of the merging firms and only then applies the analysis to the market as a whole, while the HHI is not directly related to the unilateral pricing incentives of the merging firms.  As a result, the HHI has limited value either as an initial screen or as a component to a full competitive effects analysis.  The economic literature thus has developed over the years a separate methodology to score unilateral effects concerns on the pricing incentives of the merging firms.

The basic economic approach to unilateral effects focuses on how mergers affect unilateral pricing incentives.  Regardless of the exact scoring metric adopted, unilateral effects analysis can be characterized as evaluating the tension between upward and downward pricing pressure flowing from the changes in incentives induced by the merger.  Upward pricing

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D'ÉCONOMIE ET DE STATISTIQUE 159 (1994); Gregory J. Werden, *A Robust Test for Consumer Welfare Enhancing Mergers Among Sellers of Differentiated Products*, 44 J. INDUS. ECON. 409 (1996); Carl Shapiro, *Mergers with Differentiated Products*, ANTITRUST 23 (Spring 1996); O'Brien & Salop (2000), *supra* note [X]; Joseph Farrell & Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, B.E.J. THEORETICAL ECON.: POLICIES & PERSP., vol. 10, no. 1, art. 9, at 23 (2010).  For a discussion on the application of these techniques in the practical context of merger review and enforcement, *see* Jonathan B. Baker, *Merger Simulation in an Administrative Context*, 77 ANTITRUST L.J. 451 (2011).

[12]  U.S. Dep't of Justice & Fed. Trade Comm'n, Horizontal Merger Guidelines §2.211 (1992, rev. 1997), http://www.justice.gov/atr/public/guidelines/hmg.pdf.

[13]  The U.S. Horizontal Merger Guidelines state that "The Agencies rely much more on the value of diverted sales than on the level of the HHI for diagnosing unilateral price effects in markets with differentiated products."  *See* U.S. Dep't of Justice & Fed. Trade Comm'n, Horizontal Merger Guidelines §6.1 (2010) [hereinafter, "2010 Merger Guidelines" or "Guidelines"], http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf.  *See also* Farrell & Shapiro (2010), *supra* note X; Jonathan B. Baker & Steven C. Salop, *Should Concentration Be Dropped from the Merger Guidelines?*, *in* ABA Section of Antitrust Law, Perspectives on Fundamental Antitrust Theory (2001), *reprinted in* 33 UNLA L. REV. 3 (2001).

pressure (UPP) arises when one of the merging firms would benefit from a unilateral price increase by the other merging firm.  Downward pricing pressure (DPP) arises when the merger would create efficiency benefits and thus potential incremental incentives to lower prices.[14]  A merger raises competitive concerns when the UPP dominates the DPP.

A number of related measures to score these unilateral incentives have been examined by economists prior to the GUPPI, including Critical Marginal Cost Reductions (CMCRs), the Price Pressure Index (PPI), and (net) Upward Pricing Pressure (UPP).[15]  The 2010 Merger Guidelines adopted the GUPPI as the metric for scoring unilateral effects concerns in horizontal mergers.[16]

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[14]  For the case of product quality improvements, the DPP involves quality-adjusted prices.  Product quality improvements also raise some knotty analytic issues.  Steven C. Salop & Serge Moresi, *Updating the Merger Guidelines: Comments* (Public Comment to Horizontal Merger Guidelines Review Project, 2009) at notes 62 and 63, http://www.ftc.gov/sites/default/files/documents/public_comments/horizontal-merger-guidelines-review-project-545095-00032/545095-00032.pdf; Robert Willig, *Unilateral Competitive Effects of Mergers: Upward Pricing Pressure, Product Quality, and Other Extensions*, 39 REV. INDUS. ORG.19 (2011).

[15]  These measures are discussed in Werden (1996), O'Brien & Salop (2000) and Farrell & Shapiro (2010), *supra* notes 4 and 5.  *See also* Shapiro (1996), *supra* note [X], and Jerry Hausman, Serge Moresi & Mark Rainey*, Unilateral Effects of Mergers With General Linear Demand*, 111 ECON. LETTERS 119 (2011).  These incentive scores might be viewed as simple simulation models.  Baker (2011), *supra* note [X].  They have been used for several years by competition authorities in the U.S. and other jurisdictions.  For a recent use of GUPPIs in *AT&T-T-Mobile*, *see* Federal Communications Commission*, Staff Analysis and Findings* (WT-Docket 11-65) (November 29, 2011) at Appendix C2, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-11-1955A2.pdf.  *See also* Stanley M. Besen, Stephen D. Kletter, Serge X. Moresi, Steven C. Salop, and John R. Woodbury, *An Economic Analysis of the AT&T-T-Mobile USA Wireless Merger*, J. COMPETITION L. & ECON. (2013), doi:10.1093/joclec/nhs035.

[16]  While the Guidelines do not explicitly identify the GUPPI or present the formula, they describe the GUPPI in words.  Guidelines §6.1.  *See also* Carl Shapiro, *The 2010 Horizontal Merger Guidelines: From Hedgehog to Fox in Forty Years*, 77 ANTITRUST L.J. 49 (2010), Section III.A.2; Steven C. Salop, Serge X. Moresi & John R. Woodbury, *Scoring Unilateral Effects with the GUPPI: The Approach of the New Horizontal Merger Guidelines*, CRA COMPETITION MEMO (February, 2011), http://www.crai.com/uploadedFiles/Publications/CRA_Competition_Memo_Comments_on_the_GUPPI_0211.pdf.

The GUPPI scores the incentive of the merged firm to raise the price of a product previously sold by one of the merging firms, holding constant the prices of all the other products (including the products previously sold by the other merging firm). The GUPPI thus measures "first-round incentives" of the merged firm to raise price.[17]

Formally, suppose that Firm-1 and Firm-2 are the two merging firms and assume for simplicity that each firm sells a single product.[18] The GUPPI for Firm-1 is given by:[19]

$$GUPPI_1 \quad = \quad DR_{12} M_2 \, P_2/P_1 \tag{1}$$

where $DR_{12}$ denotes the diversion ratio from Firm-1 to Firm-2,[20] $M_2$ denotes the percentage profit margin of Firm-2, and $P_2/P_1$ denotes the price ratio of Firm-2 to Firm-1. (The GUPPI for Firm-2 is given by a similar formula.) For example, suppose that $DR_{12} = 25\%$, $M_2 = 40\%$ and $P_2/P_1 = 1$.[21] Then, $GUPPI_1 = 10\%$.

The GUPPI measures only first-round incentives because it does not take into account several factors. First, all else equal, the merged firm will have an incentive to raise prices further after the first round of price increases. As the merged firm raises the price of product-1 (i.e., the product previously sold by Firm-1), its incentive to raise the price of product-2 becomes

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[17] The GUPPI does not account for several potentially important factors, as we will discuss shortly.

[18] It is straightforward to extend the analysis to multi-product firms.

[19] *See*, e.g., Shapiro (2010), *supra* note 10 at pp. 725-728.

[20] The diversion ratio from Firm-1 to Firm-2 is the fraction of the unit sales lost by Firm-1 (following a unilateral price increase by Firm-1) that would be diverted to Firm-2. Diversion ratios can be estimated from various sources, including company documents, marketing studies and surveys of customer switching patterns, natural experiments, win-loss data in bidding markets, and econometric analyses.

[21] These are the *pre-merger* diversion ratio, margin, and price ratio.

stronger, and *vice versa*. Under certain assumptions, these feedback effects between the prices of the products sold by the merged firm can be accounted for by extending the GUPPI formula.[22]

Second, the GUPPI also ignores feedback effects between the merged firm and its rivals. Specifically, the rivals of the merged firm will have an incentive to raise price following a price increase by the merged firm, and this in turn will give the merged firm an incentive to raise price further.[23]

Third, the GUPPI also ignores the incentives of non-merging firms to respond to the merger by repositioning their products or by further entry. The merged firm itself might have an incentive to repositioning its products.[24] Entry and repositioning tend to reduce the magnitude of potential price increases post-merger.

Finally, mergers typically generate efficiencies that give the merged firm an incentive to increase output—for example, by increasing the quality or reducing the price of its products. To illustrate, consider again the above example with a $GUPPI_1$ of 10%. Suppose that the merger will generate marginal cost reductions of 20% for Firm-1. Assuming that Firm-1 earns a margin

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[22] *See* Werden (1996), Shapiro (1996) and Hausman et al. (2011), *supra* notes [X] and [X].

[23] Accounting for all these feedback effects typically requires specifying a full-blown merger simulation model. Werden & Froeb (1994, 2007) and Hausman et al. (1994), *supra* notes [X] and [X]

[24] *See* Amit Gandhi, Luke Froeb, Steven Tschantz, and Gregory J. Werden, *Post-Merger Product Repositioning*, 56 J. INDUS. ECON. 49 (2008). The authors consider the standard Hotelling model of competition with differentiated products in which four firms simultaneously choose their prices as well as their "locations" or "product characteristics" on Hotelling's line. They then consider the effects of a merger on the firms' location choices and welfare. They show that the merged firm will position its two products relatively far apart in product characteristics space, so as to reduce the degree of substitutability between them. As a result, relative to the case where firms compete only in price (taking their existing product characteristics as given), a merger in this set-up reduces the diversion ratio between the merging brands and thus tends to reduce the incentives of the merging firms to increase prices post-merger. Moreover, in numerical simulations the authors show that this mitigating effect of repositioning can be substantial and dwarf other effects.

of 40%, the marginal cost savings of Firm-1 *expressed as a fraction of Firm-1's price* would equal 12%. It follows that, in this example, the merger also creates DPP on the price of Firm-1. Since this DPP of 12% is larger than the 10% GUPPI, the merger would on balance lead to a reduction in the price of product-1 (*ceteris paribus*).

The 2010 Merger Guidelines do not specify a GUPPI level that signals a presumptively anticompetitive merger. However, the Guidelines suggest a safe harbor when "the value of diverted sales is proportionately small", which they defined in terms of the GUPPI.[25] It has been suggested that the safe harbor GUPPI level is 5%.[26] The Guidelines do not specify a GUPPI level that would create an anticompetitive presumption. One possible candidate would be GUPPIs that exceed 10%. At this level, the two merging firms by themselves would comprise a relevant product market if the pass-through rate is 50%.[27]

## III. Vertical GUPPIs

Vertical mergers can raise a variety of competitive concerns, including foreclosure, coordination, and misuse of sensitive competitive information.[28] One key concern is input foreclosure. Input foreclosure involves raising the costs of competitors in the downstream

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[25] *Supra* note [X].

[26] Carl Shapiro, *Update from the Antitrust Division: Remarks to the Antitrust Law Fall Forum* (November 18, 2010) (hereinafter, "Shapiro Speech") at 24. ("Put differently, unilateral price effects for a given product are unlikely if the gross upward pricing pressure index for that product is less than 5%.")

[27] If the demand curve is linear, then the cost pass-through rate is 50% and each merging firm would have the incentive raise its price by 5% if its GUPPI is 10%. For further details, see Moresi and Salop, supra note [X].

[28] This section reviews the analysis in Serge Moresi & Steven C. Salop, *vGUPPI: Scoring Unilateral Pricing Incentives in Vertical Mergers*, 79 ANTITRUST L.J. __(2013) ((forthcoming).

market.[29]  For example, a vertical merger between an input supplier and a downstream output manufacturer can create unilateral incentives for the supplier to raise the price of its inputs to one or several "targeted" competitors of the manufacturer.[30]  The higher input prices could raise the costs of the downstream rivals, which could in turn increase the sales and profits of the downstream merger partner.

The UPP resulting from unilateral incentives following a vertical merger can be scored with "vertical GUPPIs," or "vGUPPIs" for short.  These vGUPPIs are analogous to the horizontal GUPPIs described in the previous section (which are used for scoring unilateral effects concerns in horizontal mergers).  There are vGUPPIs for the upstream and downstream merging firms and, in addition, vGUPPIs for the rivals of the downstream firm whose costs are raised as a result of the upstream firm's incentives to increase its input prices.  Like the horizontal GUPPIs, the vGUPPIs provide a direct measure of the unilateral pricing incentives.  Thus, the vGUPPIs have advantages over the vertical concentration indices.[31]  While related to

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[29] *Input* foreclosure is different from *customer* foreclosure.  Input foreclosure involves raising the costs of downstream rivals by making it more difficult for them to purchase inputs from the upstream merging firm.  Customer foreclosure involves reducing sales opportunities, and therefore the revenues, of the upstream input competitors by making it more difficult for them to sell inputs to the downstream merging firm.  For a discussion of both foreclosure concepts in the context of vertical mergers, see Riordan & Salop (1995), *supra* note [X].

[30] For a different example of input foreclosure, a vertical merger between a product distributor and a retailer can create incentives for the distributor to increase its wholesale prices to rival retailers.

[31] Three different "vertical HHI" measures have been proposed in the economics literature, based on different economic models of the upstream market.  *See* Joshua S. Gans, *Concentration-Based Merger Tests and Vertical Market Structure*, 50 J.L. & ECON. 661 (2007).  Like the horizontal HHI, these vertical HHI measures assume homogeneous products and thus are not appropriate in many merger cases involving differentiated products.

the vertical arithmetic,[32] vGUPPIs also have advantages over that methodology when the merging firms are not price regulated. The vGUPPIs also are simpler to implement and require less data than merger simulation models.[33]

Each of the vGUPPIs for vertical mergers has a form that is similar to the horizontal GUPPIs. Both the GUPPIs and the vGUPPIs are based on diversion ratios, price-cost margins and price ratios. In fact, the vGUPPIs also can be related directly to the GUPPIs for certain hypothetical horizontal transactions involving the downstream merging firm. This is not surprising. If the downstream merging firm were to acquire a competitor (instead of the upstream firm), the GUPPI would be used to score the downstream firm's incentive to raise the output price of that competitor (because the downstream firm would recapture some of the customers lost by that competitor). By instead acquiring the upstream firm, the downstream firm cannot raise the output price of the competitor *directly*, but it might be able to do so *indirectly* by raising the price of the input that the upstream firm charges to that competitor. Thus, the *vGUPPIu* and *vGUPPIr* (which score the pricing incentives of the upstream merging firm and the targeted competitor, respectively) are related to the horizontal GUPPI for a hypothetical merger of the downstream merging firm and the targeted competitor.

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[32]  The standard vertical arithmetic calculations carried out in vertical merger cases assume that the upstream firm forecloses by refusing to sell inputs to the targeted downstream rivals, rather than by charging them higher input prices.

[33]  For simulation models of vertical mergers, *see* Michael A. Salinger, *Vertical Mergers and Market Foreclosure*, 103 Q.J. ECON. 345 (1988); Kenneth Hendricks & R. Preston McAfee, *A Theory of Bilateral Oligopoly*, 48 ECON. INQUIRY 391 (2010). These models focus on mergers between firms that are already partially vertically integrated, and thus their mergers have both horizontal and vertical components. These models also assume homogeneous products both upstream and downstream, whereas many vertical mergers involve firms that produce differentiated products. In contrast, the vGUPPIs are based on a model with product differentiation both upstream and downstream. For further discussion on vertical merger simulation models, *see* Francine Lafontaine & Margaret Slade, *Vertical Integration and Firm Boundaries: The Evidence*, 45 J. ECON. LITERATURE 629 (2007).

The main difference between the horizontal GUPPIs and the vGUPPIs is that the merging partners in a vertical merger operate at different levels in the production chain.  This means that the vGUPPIs of the upstream and downstream merger partners involve prices at different levels of the production chain.  The *vGUPPIu* of the upstream merging firm involves the merged firm's incentives to raise its *input* price to downstream rivals.  In contrast, the *vGUPPId* of the downstream merging firm involves its incentive to raise its *output* price post-merger.

These two levels of production also add complexity to the interpretation of the vGUPPIs for scoring pricing incentives.  Even if the upstream firm has the incentive to raise its input price significantly, that price increase may not raise the costs of the downstream competitors very much, if the input has good substitutes or if it is not a significant cost factor for the downstream competitors (or both).  For example, suppose that an automobile company were to acquire a spark plug supplier and had the incentive to (say) double the price of spark plugs to its automobile competitors.[34]  Because spark plugs are only a small cost item, that doubling may not materially raise the cost of those rivals, and thus may not lead to significant increases in the cost of automobiles.  The *vGUPPIr* measures that incentive.  Thus, the *vGUPPIr* score provides a better measure than the *vGUPPIu* of the UPP that the targeted downstream rivals would have post-merger.

Vertical mergers provide various opportunities for efficiency gains.[35]  In particular, elimination of double marginalization (EDM) gives the downstream merging firm an incremental incentive to reduce the price of its products after the merger, other things held constant, if the

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[34]  For example, *see Ford Motor Company v. United States*, 405 U.S. 562 (1972).

[35]  The activities of firms at different product levels are complementary to one another.  Actions to promote products at one level often benefit products at the other level.  The activities also often require some degree of cooperation.  *See* Riordan & Salop (1995), *supra* note [X], at 522.

pre-merger input price exceeds marginal cost.[36]  Thus, the extent to which the downstream

merging firm uses the input produced by the upstream merging partner and the price paid for that

input also will be relevant factors.  This incentive can be taken into account in the *vGUPPId*.

The *vGUPPIr* and *vGUPPId* provide evidence of the UPP (or DPP) in the output market.

These vGUPPIs  can be derived from a model of vertical mergers.  Formally, suppose

that Firm-U and Firm-D are the upstream and downstream merging firms, respectively, and let

Firm-R be a targeted rival of Firm-D.[37]  Assuming for simplicity that Firm-R cannot substitute

the input supplied by Firm-U with inputs from other suppliers, the vGUPPI for Firm-U is given

by:[38]

$$vGUPPIu \quad = \quad DR_{RD} M_D \, P_D/W_R \tag{2}$$

where $DR_{RD}$ denotes the diversion ratio from Firm-R to Firm-D,[39] $M_D$ denotes the downstream

merger partner's percentage profit margin, and $P_D/W_R$ denotes the output/input price ratio, i.e.,

the price of the output sold by the downstream merging firm divided by the price of the input

(per unit of output) sold by the upstream merging firm to the targeted downstream rival.[40]  For

example, suppose that $DR_{RD} = 25\%$, $M_D = 40\%$ and $P_D/W_R = 6$.  Then, $vGUPPIu = 60\%$.

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[36]  It is important to emphasize that EDM is not the inevitable impact of a vertical merger.  *See supra* note 33.

[37]  It is straightforward to extend the analysis to multiple targeted rivals.

[38]  For the derivation of Equations (2) and (3), *see* Moresi & Salop (2013), *supra* note [X].  The authors also analyze the case with input substitution.

[39]  $DR_{RD}$ is the diversion ratio from Firm-R to Firm-D, i.e., the output gained by Firm-D expressed as a fraction of the output lost by Firm-R (which in the absence of input substitution is equal to the input sales to Firm-R lost by Firm-U) as a result of the targeted input price increase.

[40]  Equation (2) assumes that 1 unit of output requires 1 unit of input from the upstream merging firm.  Thus, the input price $W_R$ must be calculated as being equal to the targeted firm's total payments to the upstream merging firm divided by the targeted firm's total quantity of output (that uses the upstream merging firm's input).

The form of *vGUPPIu* in equation (2) is very similar to the standard GUPPI used for horizontal mergers. Like the standard GUPPI, the *vGUPPIu* is the product of a diversion ratio, a profit margin, and a price ratio. The *vGUPPIu* scores the incentive of the merged firm to raise the input price charged to Firm-R (the targeted rival of the downstream division of the merged firm). An increase in the input price would raise the marginal cost of production of the targeted downstream rival, which would give the rival an incentive to raise its own price. This mechanism shows the relevance of the upward pricing incentives of the downstream rival whose costs would be raised post-merger. The *vGUPPIr* translates the merged firm's incentive to raise the input price it charges to a targeted downstream rival into the resulting impact on the incentive of the targeted rival to raise its output price. The *vGUPPIr* is derived from *vGUPPIu* as follows:

$$vGUPPIr \quad = \quad vGUPPIu \; \frac{W_R}{P_R} \; PTR_U \tag{3}$$

where $PTR_U$ denotes the cost pass-through rate of the upstream merging firm[41] and $P_R$ denotes the price of the output sold by the targeted downstream rival.[42]

To illustrate, consider again the example above, in which the *vGUPPIu* equals 60%. Suppose the upstream pass-through rate $PTR_U$ is equal to 50%.[43] Suppose further that the output price $P_R$ of the targeted downstream rival is equal to the output price $P_D$ of the downstream merging firm. Thus, the output price of the targeted rival is also six times larger than the input

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[41]  For example, suppose a supplier's marginal cost of serving a customer increases by 25 cents per unit, and this 25-cent cost increase leads the supplier to raise the price it charges to the customer by 20 cents. In this example, the cost pass-through rate would equal 80% (i.e., 20/25).

[42] The *vGUPPIr* can be related directly to the horizontal GUPPI for a hypothetical merger between the targeted rival and the downstream merging firm. This is not surprising. By acquiring the upstream firm, the downstream firm is able raise the price of the rival *indirectly* by raising the price of the input that the upstream merging firm charges to that rival. Specifically, we have $vGUPPIr = GUPPIr \times PTR_U$, where $GUPPIr = DR_{RD} \times M_D \times P_D / P_R$.

[43]  This result follows from linear demand and is commonly used in discussing horizontal GUPPIs.

price charged to the targeted rival, which implies $W_R/P_R = 1/6$. In this example, therefore, Equation (3) yields $vGUPPIr = 5\%$ (i.e., $0.6 \times 0.5/6$).

As noted above, there are two main benefits to calculating the *vGUPPIr*. First, the *vGUPPIr* is a better predictor than *vGUPPIu* of the potential impact of the vertical merger on the customers of the targeted downstream rival. Second, the *vGUPPIr* is comparable to the *vGUPPId* for the output price of the downstream merging firm, as described below. This is important because, in some cases, a vertical merger might create UPP upstream and DPP downstream. Assessing the net effect of the merger by combining a positive *vGUPPIu* and a negative *vGUPPId* is likely to be difficult because *vGUPPIu* pertains to the upstream price of the *input*, while *vGUPPId* pertains to the downstream price of the *output*. However, combining a positive *vGUPPIr* and a negative *vGUPPId* is easier because both pertain to downstream prices.

A vertical merger also can have an impact on the incentives of the merged firm to increase (or possibly decrease) the output price charged by the downstream merger partner. The downstream merging firm may have a unilateral incentive to raise the price of its output above the pre-merger level. This is because consumer substitution away from the firm to rivals increases the input sales that the upstream merger partner makes to rivals, which tends to increase the profits of the upstream merger partner. This UPP is the only downstream incentive effect if the downstream merging firm does not use the input produced by the upstream merger partner. In this case, the incremental profits of the upstream merger partner (resulting from the incremental input sales to downstream rivals) give the downstream firm an incentive to raise price that it does not have absent the merger.

However, if the downstream merging firm also uses the input of the upstream merger partner, then the downstream firm also may have a unilateral incentive to *reduce* its output price

below the pre-merger level, what has been called the elimination of double marginalization (EDM) effect.[44] An output expansion by the downstream firm increases the input sales that the upstream firm makes to the downstream firm, which tends to increase the profits of the upstream firm.[45]

The vGUPPI for the downstream merging firm is given by:

$$vGUPPId \quad = \quad DR_{DU} M_U \frac{W_U}{P_D} \quad - \quad M_{UD} \frac{W_D}{P_D} \tag{4}$$

where $DR_{DU}$ denotes the vertical diversion ratio from the downstream merging firm to the upstream merger partner, $W_U$ and $M_U$ denote the upstream merging firm's price and percentage profit margin (on average across all the customers of the upstream merging firm, excluding the downstream merger partner), and $M_{UD}$ and $W_D$ denote the margin and price of the upstream merging firm on input sales to the downstream merging firm.

The first term in Equation (4), $DR_{DU} \times M_U \times \frac{W_U}{P_D}$, is the UPP on the downstream merging firm that arises if its rivals are purchasing the input of the upstream merger partner. This is the only effect if EDM is not found to be merger-specific. The second term, $M_{UD} \times \frac{W_D}{P_D}$, is the DPP

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[44] This is referred to as "elimination of double marginalization" because, when the upstream firm in the pre-merger market sets an input price above its marginal cost of the input, the downstream firm then sets an output price that marks up the marginal cost of the input a second time. In contrast, the vertically integrated firm has the incentive to mark up the marginal cost only once. *See* JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION (1992) §4.2.

[45] EDM is not always merger-specific. For example, the downstream merging firm may already be paying a pre-merger marginal price of the input equal to marginal cost, either as a result of upstream competition, two-part tariffs or other non-linear pricing, or because it would be practical to achieve EDM absent the merger. In other situations, the downstream merging firm may not have a technology that uses the input produced by the upstream merger partner or it may have entered into long-term contracts with other suppliers. The merged firm also may have the incentive to transfer inputs internally at price above marginal cost. *See* Riordan & Salop, *supra* note [X]; Chaim Fershtman & Kenneth L. Judd, *Equilibrium Incentives in Oligopoly*, 77 AM. ECON. REV. 927 (1987); Steffen Ziss, *Hierarchies, intra-firm competition and mergers*, 25 INT'L J. INDUS. ORG. 237 (2007).

on the downstream merging firm that arises from EDM if the downstream merging firm is also purchasing the input of the upstream merger partner.[46]  *See* the discussion before Equation (4).

The vertical diversion ratio $DR_{DU}$ can be related to the horizontal diversion ratios from the downstream merging firm to its rivals.  For example, if all the rivals of the downstream merging firm purchase the input sold by the upstream merger partner (and one unit of output requires one unit of that input), then $DR_{DU}$ is equal to the "market recapture rate" (or "aggregate diversion ratio") following a unilateral price increase by the downstream merging firm.[47]  This can be illustrated with the following example.

Suppose the downstream merging firm unilaterally raises the price of its output and, as a result, its unit sales fall by 100 units.  Suppose further that the market recapture rate is 75% so that the other downstream firms capture 75 out of those 100 units.  Suppose also that one-third of those 75 units (i.e., 25 units) require the input of the upstream merging firm.  Thus, the diversion ratio from the downstream merging firm to the upstream merger partner is $DR_{DU} = 25\%$. Suppose the upstream merging firm earns a margin $M_U = 50\%$ on input sales to rivals of the downstream merger partner and the input price per unit of output is half the output price of the

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[46]  Equation (4) implies that if market demand is perfectly price inelastic and downstream firms are symmetric, then *vGUPPId* = 0.  This key result follows because a price increase by the downstream merging firm has no effect on total market output (since market elasticity is zero) and also no effect on the total input sales and profits of the upstream merger partner (since the latter earns the same margin on sales to *all* the downstream firms).  Thus, the merger does not create any incentive for the downstream merging firm to change the price of its output, i.e., *vGUPPId* = 0.  Formally, zero market elasticity and symmetry imply $DR_{DU} = 1$, $W_U = W_D$ and $M_U = M_{UD}$.  Equation (4) then implies *vGUPPId* = 0.

[47]  The market recapture rate is the fraction of the output lost by the downstream merging firm that would be recaptured by all the other output manufacturers (including the targeted rivals).  The 2010 Merger Guidelines § 4.1.3 use the market recapture rate in the context of market definition.

downstream merger partner, i.e., $W_U/P_D = 0.50$. From Equation (4), if EDM is not merger-specific, $vGUPPId = 6.25\%$ (i.e., $0.25 \times 0.50 \times 0.50$).

Accounting for EDM will reduce the $vGUPPId$ and possibly make it negative. For example, consider again the previous example where $vGUPPId = 6.25\%$ in the absence of EDM. Suppose the upstream merging firm also earns a margin of 50% on input sales to the downstream merging firm, and the input/output price ratio also equals 0.5 for the downstream firm. Then, from Equation (4), $vGUPPId = -18.75\%$ (i.e., $0.0625 - 0.5 \times 0.5$). This net DPP arises because a price reduction by the downstream merging firm expands output and increases its input purchases from the upstream merger partner by more than it reduces the rivals' input purchases. Therefore, in this case, the merger on balance creates DPP on the downstream merging firm.

In short, merger-specific EDM can make a substantial difference to the analysis, even if there is no potential for input substitution. If $vGUPPId < 0$, it will mitigate and possibly reverse the impact of $vGUPPIr > 0$, which would lead to a lower likelihood of significant adverse effects. The first-round *net* incentive effect on downstream prices then might be gauged roughly by calculating a weighted average of $vGUPPIr$ and $vGUPPId$. The unilateral effects analysis that forms the basis for the vGUPPIs involve only first-round effects. This analysis specifically assumes that competing input suppliers do not raise their prices in response to the merger-induced price increase by the upstream merging firm. If they did, it could significantly increase the UPP placed on the targeted rivals.[48] This analysis also does not take into account potential

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[48] While horizontal GUPPIs also are calculated on the assumption that other firms do not change prices in response (as do the vertical GUPPIs), the impact of price increases by other upstream firms has played an important role in the analysis of the anticompetitive effects of vertical mergers. *See* Janusz A. Ordover, Garth Saloner & Steven C. Salop, *Equilibrium Vertical Foreclosure*, 80 AM. ECON. REV. 127 (1990).

responses by other input suppliers.[49] Nor does it take into account the offsetting impact of

merger-specific EDM on the pricing incentives of other input suppliers.

The use of vGUPPIs can be incorporated into the U.S. Vertical Merger Guidelines if and

when they are revised. We do not propose vGUPPI safe harbors or anticompetitive

presumptions at this time. Our analysis instead can form the basis for a later policy debate on

that issue.


## IV.    Coordination GUPPIs

We have formulated two indices to score the increase in the incentives for coordination

and how the incentives change as a result from a merger. These indices are premised on the

assumption that the coordination involves a uniform percentage price increase by each of the

firms in a hypothetical coordinating group. One index involves coordination by a cartel with

through side payments. The other index involves parallel accommodating conduct without side

payment by a coordinating group. For each type of coordination, we refer to the index that

measures the incentives for coordination as the cGUPPI and the merger-induced change in the

incentives as the "Delta cGUPPI," or the $\Delta$cGUPPI for short.

The cGUPPI is defined as the profit-maximizing price increase that the hypothetical group

would implement, where the prices of all firms are constrained to increase by the same

percentage amount, with or without side payments. The higher the CPPI, the greater the

incentives of the firms comprising the hypothetical group to attempt coordinated price increases.

The cGUPPI with side payments is closely related to the hypothetical monopolist test for

market definition. If the profit-maximizing uniform SSNIP for a hypothetical cartel consisting of

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49 This analysis also assumes that suppliers of complementary inputs do not reduce their prices
in response to the merger-induced price increase by the upstream merging firm.

would-be coordinating firms exceeded 5%, then the products of these firms would constitute a relevant antitrust market. Moreover, if the hypothetical cartel is comprised of only two firms, then the cGUPPI also coincides with the uniform simultaneous GUPPI used to score the unilateral effects concerns for a merger of these two firms.[50]

In the context of a merger, there are pre-merger and post-merger cGUPPIs. For example, suppose that there are two leading firms and then several smaller firms, and the concern is coordination solely between the two leading firms. Suppose one of these firms acquires a smaller competitor. In this situation, the pre-merger and post-merger cGUPPIs will differ, and the ΔcGUPPI (i.e., the increase in the cGUPPIs). The cGUPPI can be formulated to gauge the possibility that the post-merger hypothetical cartel would increase the prices of all three firms. Or it can be formulated to gauge the increase in the prices just of the products of the two leading firms, but now also considering the effect of the price increase on the profits of the acquired firm.

While the cGUPPI can be used to gauge coordinated effects concerns in general, it is particularly relevant for scoring parallel accommodating conduct (PAC) concerns. PAC has a long history in oligopoly theory, dating back more than seventy years.[51] PAC is a type of coordinated conduct that does not require an agreement. Instead, it involves a firm engaging in a

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[50] It also is possible to calculate the profit-maximizing non-uniform simultaneous price increases. *See* Jerry Hausman, Serge Moresi, and Mark Rainey, *Unilateral Effects of Mergers with General Linear Demand*, 111 Economics Letters 119 (2011).

[51] *See*, *e.g.*, Robert L. Hall and Charles J. Hitch, *Price Theory and Business Behavior*, 2 Oxford Economic Papers 12 (1939); Paul Sweezy, *Demand Under Conditions of Oligopoly*, 47 Journal of Political Economy 568 (1939); Eric Maskin and Jean Tirole, *A Theory of Dynamic Oligopoly, II: Price Competition, Kinked Demand Curves, and Edgeworth Cycles*, 56 Econometrica 571 (1988); Jonathan Eaton and Maxim Engers, *Intertemporal Price Competition*, 58 Econometrica 637 (1990).

certain conduct, with the expectation – but without any prior agreement – that one or more other firms will follow that same conduct.

The language of the 2010 Merger Guidelines gives greater prominence to the concept of parallel accommodating conduct, explicitly identifying these PAC effects as a form of coordinated interaction. As stated in the 2010 Merger Guidelines:

> Coordinated interaction alternatively can involve parallel accommodating conduct not pursuant to a prior understanding. Parallel accommodating conduct includes situations in which each rival's response to competitive moves made by others is individually rational, and not motivated by retaliation or deterrence nor intended to sustain an agreed-upon market outcome, but nevertheless emboldens price increases and weakens competitive incentives to reduce prices or offer customers better terms.[52]

A somewhat different cGUPPI can be formulated for gauging PAC concerns because the cGUPPI basically coincides with the highest collusive price that can be sustained in a repeated game where firms behave in a way that can be interpreted as PAC. Specifically, Lu and Wright consider a repeated price competition game with differentiated products in which firms expect that any price deviations (upwards or downwards) will be matched by rivals.[53] In other words, starting from a status quo (e.g., the static Bertrand-Nash equilibrium), a firm can initiate a price increase with the expectation that it may be matched in the following period. If it is matched, then the new higher price becomes the new status quo; if it is not matched, then the initiating firm rescinds the price increase and the original status quo remains. The authors derive the

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[52] *Guidelines* at §7.

[53] *See* Yuanzhu Lu and Julian Wright, *Tacit Collusion with Price-Matching Punishments*, 28 International Journal of Industrial Organization (2010).

highest collusive price that can be sustained in equilibrium. The cGUPPI for PAC also is closely related to Jonathan Baker's concept of mavericks.[54]

It is noteworthy that the ΔcGUPPI can be negative when firms are not all identical. This is because the identity and incentives of the firm that is least willing to jointly raise prices can be different post-merger, as shares and diversion ratios reflect the new post-merger ownership. For example, suppose that the acquired firm would have a lower preferred uniform price increase than any of the members of the pre-merger hypothetical coordinating group.

When the members of the hypothetical coordination group are the same both before and after the merger, and there are no side payments, the ΔcGUPPI is positive. This is because there are spillover benefits of coordination that are not taken into account by each participant. In contrast, the ΔcGUPPI is zero in this situation when side payments are possible. This is because all the benefits of coordination can be internalized in the premerger world by the side payments.

For symmetric firms, side payments are not necessary, so the cGUPPI is identical for both a hypothetical cartel and for PC. The cGUPPI here is the (limit) highest collusive price that can be sustained by firms with zero discount rates, or .

$$cGUPPI = [D/(1-D)] \ x \ m \tag{5}$$

where $D$ is the diversion rate from one firm to all the other firms in the hypothetical coordinating group and $m$ is the margin. Not surprisingly, this cGUPPI is identical to the uniform GUPPI for a merger of all the firms in the group. (This is because the uniform GUPPI involves a uniform

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[54] Jonathan B. Baker, *Mavericks, Mergers, and Exclusion: Proving Coordinated Competitive Effects Under the Antitrust Laws*, 71 N.Y.U. L.R.135 (2002).

price increase for the merging firms.)  If the firms are asymmetric, then the cGUPPI formula is more complicated and the cGUPPIs differ when side payments are not permitted.

To illustrate, consider a five-firm symmetric oligopoly.  Suppose that the firms are currently at the static Bertrand equilibrium, with a margin of 30%.  Furthermore, suppose that diversion ratio between any two firms is 20%, which is consistent with diversion ratios being proportionate to volume shares and a retention ratio of 80%.  In this case, the cGUPPI is 20%.[55] (The profit-maximizing SSNIP for a hypothetical cartel consisting of any three firms is 10%.)

If the merging firms are both in the pre-merger hypothetical cartel, then there is no effect of the merger on the cGUPPI.  Suppose instead that a member of the hypothetical cartel were to acquire a non-member firm.  The post-merger cGUPPI will rise for two reasons.  First, the post-merger hypothetical cartel will now include the acquired firm.  Hence, in assessing the profitability of a uniform SSNIP, the cartel will now take into account lost sales (due to the SSNIP) that are recaptured by the acquired firm, whereas pre-merger these sales were considered by the cartel as lost.  Second, the would-be cartel could expand the scope of their coordinated interaction in the post-merger world by also raising the price of the acquired firm's product.  This latter effect may or may not be present, depending on the specifics of the merger at hand.

If the post-merger hypothetical cartel subjects all four prices (i.e., including that of the acquired firm) to the SSNIP, then the post-merger cGUPPI rises to 45%[56] and the ΔcGUPPI is 25% (i.e., 45% - 20%).  If instead the post-merger hypothetical cartel does not subject the price

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[55]  This is calculated as $\dfrac{40\%}{1-40\%} \times 30\%$, where 40% is the aggregate diversion ratio from one cartel member to the other two cartel members, and 30% is the margin.

[56]  This is calculated as $\dfrac{60\%}{1-60\%} \times 30\%$, where 60% is the aggregate diversion ratio and 30% is the margin.

of the acquired fourth firm to the SSNIP, then the post-merger cGUPPI rises only to 30% and the ΔcGUPPI would be 10%.

The use of the cGUPPI and ΔcGUPPI raises several caveats. First, like the GUPPI, the ΔcGUPPI is just an index; it is neither a prediction of the post-merger price increase, nor is it intended to capture every detail of the merger impact on the equilibrium outcome of a dynamic oligopoly model.[57] Thus, the ΔcGUPPI should be used in conjunction with other evidence. For example, the existence of a positive ΔcGUPPI alone does not prove that coordination necessarily will be attempted or that it will succeed. In fact, starting from an assumed pre-merger Bertrand equilibrium point, the GUPPI *always* suggests that any group of two or more firms would have an incentive to engage in coordinated interaction. However, it often is the case that no such coordinated interaction occurs pre-merger. There are various impediments to successful coordination, such as lack of information; fear of entry or repositioning; or incentives to secretly or openly cut prices after initial coordination. These impediments also can prevent successful coordination from occurring post-merger, even if the merger increases the CPPI significantly.

Second, the cGUPPI and the ΔcGUPPI also may be lower when coordination already is occurring. In this case, while a merger may not lead to higher prices through coordinated interaction, it could help to entrench the coordination already occurring. This is similar to the concerns raised by the classic *Cellophane* fallacy. Thus, when there is evidence of pre-merger coordination, low values for the GUPPI and ΔcGUPPI do not eliminate coordinated effects concerns from a merger.

## V.    Conclusions

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[57]   This is in contrast to methods of coordinated effects analysis that require a full merger simulation model in order to describe the full equilibrium in a market. *See*, *e.g.*, William E. Kovacic, Robert C. Marshall, Leslie M. Marx, and Steven P. Schulenberg, *Quantitative Analysis of Coordinated Effects*, 76 Antitrust Law Journal 397 (2010).

These various GUPPIs can be used to score the impact of a merger on pricing incentives. Thus, they are candidates to replace or supplement the role of market concentration as an initial screen for merger analysis. They are useful. However, the use of these GUPPIs does not provide a complete competitive effects analysis. The GUPPIs gauge only first-round effects and ignore other factors that affect the ultimate impact of the merger. These factors include rivals' pricing responses, entry and repositioning, and efficiencies. The simple GUPPIs here also raise the prices of only one merging firm at a time, though simultaneous price changes could be calculated.

These GUPPIs also are not the only potential incentive scoring methodologies. Instead, they are one more step towards formulating a full menu of tools to use for more economically sophisticated merger analysis. There are numerous other oligopoly models besides Bertrand price competition with differentiated products, and each model would have its own set of GUPPIs.[58] There also can be multiple possible indices for a given oligopoly model.[59] We hope

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[58] Economists have analyzed numerous oligopoly models, including the Bertrand model with differentiated products; the Cournot model with homogeneous products; the Stigler defection/punishment model; the Stackelberg leader/follower model; and the dominant firm/perfectly competitive fringe model; among others. For the Bertrand model, *see*, *e.g.*, Jerry Hausman, Gregory Leonard, and J. Douglas Zona, *Competitive Analysis with Differenciated Products*, 34 Annales D'Economie et de Statistique 159 (1994). For the Cournot model, *see*, *e.g.*, Joseph Farrell and Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis*, 80 American Economic Review 107 (1990). For the Stigler defection/punishment model, *see*, *e.g.*, James W. Friedman, *A Noncooperative Equilibrium for Supergames*, 38 Review of Economic Studies 1 (1971); Douglas Bernheim and Michael D. Whinston, *Multimarket Contact and Collusive Behavior*, 21 RAND Journal of Economics 1 (1990). For the Stackelberg model, *see*, *e.g*., Marcel Boyer and Michel Moreaux, *On Stackelberg Equilibria with Differentiated Products: The Critical Role of the Strategy Space*, 36 Journal of Industrial Economics 217 (1987). For the dominant firm model, *see*, *e.g*., Gautam Gowrisankaran and Thomas J. Holmes, *Mergers and the Evolution of Industry Concentration: Results from the Dominant-Firm Model*, 35 RAND Journal of Economics 561 (2004). The Merger Guidelines refer to some of these oligopoly models. In particular, the analysis of unilateral conduct in differentiated-product markets in the 1992 and 2010 Merger Guidelines is consistent with the Bertrand model with differentiated products. The concepts of the "value of diverted sales" in the 2010 Merger

that other indices will be formulated within the contexts of other oligopoly models.  We invite

others to formulate other incentive scoring methodologies for other forms of coordination in

horizontal mergers and other types of foreclosure in vertical mergers.

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Guidelines and the associated "gross upward pricing pressure index" (GUPPI) can be derived from that Bertrand model.  Similarly, the treatment of coordinated effects in the 1982 and 1992 Merger Guidelines is consistent with the Stigler defection/punishment model.

[59]  For example, in the context of mergers in Bertrand markets with differentiated products, unilateral effects concerns have been scored with the single-product GUPPI, the simultaneous GUPPI, and the CMCR.  *See* Jerry Hausman et al., *supra* note 5 for the simultaneous GUPPI, and Gregory J. Werden, *A Robust Test for Consumer Welfare Enhancing Mergers among Sellers of Differentiated Products*, 44 J. Indus. Econ. 409 (1996) for the CMCR.  *See* also the Indicative Price Rise used in Office of Fair Trading, *Anticipated Acquisition of the Online DVD Rental Subscription Business of Amazon Inc. by LOVEFiLM International Limited* (2008) at 13-14; and testimony by Alison Oldale in Federal Trade Commission, *Horizontal Merger Guidelines Review Project*, Hearing, Washington D.C. (December 3, 2009).

# cGUPPI Technical Appendix

In this appendix, we derive the cGUPPIs formally.

## A. Coordination with Side Payments

We adopt a notation to allow for multi-product firms by distinguishing between firms and products (brands) and denoting by $B_i$ the set of brands sold by firm $i$. We use $P_j$, $C_j$, $Q_j(P_j)$ } and $m_j$ to denote the price, marginal cost, demand and percentage margin of brand $j$, respectively. Moreover, $\delta_{jk}$ denotes the diversion ratio from brand $j$ to brand $k$, and we adopt the convention that $\delta_{jj} = -1$. Using this notation, one can show that firm $i$'s first-order condition of profit-maximization implies that the own-price elasticity of demand for any brand $j$ sold by the firm (which we denote $\eta_j$) satisfies the following equation:

$$\frac{1}{\eta_j} = -\sum_{k \in B_i} \delta_{jk} m_k P_k / P_j \tag{A1}$$

Starting from the Bertrand-Nash equilibrium as the initial status quo, suppose that the owners of a collection of $M$ brands were to coordinate and raise the prices of these $M$ brands by the same percentage amount $s$. (In antitrust jargon, $s$ is commonly referred to as a uniform SSNIP.) Thus, the price of each of these $M$ brands would increase from $P_j$ to $(1+s)P_j$. Note that the $M$ brands subject to the coordinated price increase may not include all the brands sold by the would-be coordinating firms. For example, if each of the would-be coordinating firms owns a premium and a value brand, coordination may involve only the prices of the firms' premium

brands. For this reason, it is convenient to assume that the would-be coordinating firms also own $N$ brands that are not subject to the SSNIP.

We refer to the would-be coordinating firms as the "hypothetical cartel" instead of the usual "hypothetical monopolist." This is to highlight the fact that the "cartel members" assess the effect of raising the prices of $M$ brands on the total profits of the $M+N$ brands that they own (i.e., the cartel's profits also include the profits that the cartel members earn on brands that are not subject to the SSNIP).[60]

A uniform SSNIP $s$ would be profitable for the hypothetical cartel facing linear demand, as long as:[61]

$$\sum_{j \in M} \left\{ \left[ (1+s)P_j - C_j \right] \times Q_j \times \left[ 1 + \sum_{k \in M} s\eta_j \delta_{jk} \frac{P_k(1+s) - C_k}{P_j(1+s) - C_j} + \sum_{t \in N} s\eta_j \delta_{jt} \frac{P_t - C_t}{P_j(1+s_j) - C_j} \right] \right\} \geq \sum_{j \in M} (P_j - C_j)Q_j \tag{A2}$$

where the own-price elasticity terms $\eta_j$ are given by equation (A1). This expression further reduces to:

$$\sum_{j \in M} P_j Q_j \left[ 1 + \sum_{k \in M} \eta_j \delta_{jk} (m_k + s) \frac{P_k}{P_j} + \sum_{t \in N} \eta_j \delta_{jt} m_t \frac{P_t}{P_j} \right] \geq 0 \tag{A3}$$

Let $s^{BE}$ denote the break-even SSNIP such that equation (3) holds with equality.[62] The cGUPPI then is equal to $s^{BE}$, or

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[60] The 2010 Guidelines use the concept of a "hypothetical cartel" in discussing market definition when there are multi-product firms. Guidelines at n. 4.

[61] We assume linear demand functions, but equation (A2) alternatively can be viewed as a linear approximation.

[62] Equation (A3) assumes that the resulting quantities following the SSNIP are non-negative.

$$s^{BE} = cGUPPI/2 = -\frac{\sum_{j\in M}P_jQ_j + \sum_{j\in M}Q_j\eta_j\sum_{k\in M}\delta_{jk}m_kP_k + \sum_{j\in M}Q_j\eta_j\sum_{t\in N}\delta_{jt}m_tP_t}{\sum_{j\in M}Q_j\eta_j\sum_{k\in M}\delta_{jk}P_k} \qquad (A4)$$

If the hypothetical cartel's objective function is symmetric around the profit-maximizing SSNIP (e.g., if demand is linear, as assumed here), then the profit-maximizing SSNIP, which we denote as $s^*$, will be equal to *half* of the cGUPPI (i.e., the break-even SSNIP $s^{BE}$).
If the firms comprising the hypothetical cartel each sell only one brand and are symmetric (i.e.,
$P_j = P$, $m_j = m$ and $Q_j(P) = Q(P)$), then the cGUPPI can be written as follows:

$$cGUPPI = [D/(1\text{-}D)] \ x \ m \qquad (A5)$$

where $D = \sum_{j,k\in M, j\neq k}\delta_{jk}$ denotes the "aggregate diversion ratio" from any one member-firm to all the other firms in the hypothetical cartel.[63] Of course, with symmetric firms, no side payments are needed so equation (9) also will describe the cGUPPI for the case of parallel accommodating conduct.

## B. Parallel Accommodating Conduct

A particularly relevant model of PAC is found in Lu and Wright (2010).[64] The price level resulting in the equilibrium of that model coincides with the joint profit maximizing price level when the coordinating firms are symmetric and very patient. That correspondence disappears when firms are asymmetric. Lu and Wright discuss an asymmetric version of their model, but do

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[63] The Guidelines refer to the aggregate diversion ratio as the "recapture percentage."

[64] Lu and Wright (2010) analyzes a coordinated effects model under a particularly simple continuous intertemporal reaction function, in which, loosely speaking, firms match the lowest price set by any firm in the previous period. An earlier version of this paper contained a similar derivation of the price equilibrium in a price matching duopoly.

not derive the equilibrium prices. We present the equilibrium prices here for the case of single-product firms and discuss the implications for the cGUPPI.

When each firm owns a single product, the joint breakeven SSNIP in (8) simplifies to

$$s^{BE} = -\frac{\sum_{j \in M} P_j Q_j + \sum_{j \in M} Q_j \eta_j \sum_{k \in M} \delta_{jk} m_k P_k}{\sum_{j \in M} Q_j \eta_j \sum_{k \in M} \delta_{jk} P_k}$$

$$= \frac{\sum_{k \in M} m_k P_k \sum_{j \neq k} \delta_{jk} Q_j \eta_j}{\sum_{k \in M} Q_k \eta_k P_k - \sum_{k \in M} P_k \sum_{j \neq k} \delta_{jk} Q_j \eta_j} \tag{A6}$$

Alternatively, consider the incentives of a single (patient) firm $k$ to match a PAC price increase of $s$ or to revert to the non-cooperative equilibrium price level. Assuming current prices reflect the non-cooperative Nash equilibrium, the breakeven SSNIP for firm $k$, $\widehat{s}_k^{BE}$, satisfies

$$Q_k m_k P_k = (Q_k + \widehat{s}_k^{BE} \sum_j \delta_{jk} Q_j \eta_j)(m_k P_k + \widehat{s}_k^{BE} P_k) \tag{A7}$$

Solving for $\widehat{s}_k^{BE}$,

$$\widehat{s}_k^{BE} = \frac{\sum_{j \neq k} \delta_{jk} Q_j \eta_j}{Q_k \eta_k - \sum_{j \neq k} \delta_{jk} Q_j \eta_j} m_k \tag{A8}$$

The maximum SSNIP that is sustainable is the minimum of the $\widehat{s}_k^{BE}$, since unless all firms are willing to match the price increase pricing will revert to the non-cooperative equilibrium. Thus,

$$\widehat{s}^{BE} = \min_k \{\widehat{s}_k^{BE}\} \tag{A9}$$

where $\widehat{s}^{BE}$ is the maximum breakeven SSNIP from PAC in the absence of side payments.

Comparing (A8) to (A6), note first that $s^{BE}$ depends on the relative prices of the different

coordinating products.  In contrast, $\widehat{s}_k^{BE}$ does not depend on prices but only on margins,

diversion ratios, and the elasticity in response to a price increase.  In the limit as $p_k$ increases

relative to prices of other firms, $s^{BE}$ approaches $\widehat{s}_k^{BE}$.  In general, one can show that

$$\min_k\{\widehat{s}_k^{BE}\} \le s^{BE} \le \max_k\{\widehat{s}_k^{BE}\} \qquad \text{(A10)}$$

and therefore $\widehat{s}^{BE} \le s^{BE}$.

This maximum breakeven SSNIP in equation (A10) is equal to cGUPPI/2, when firms are

unable to use side payments in the PAC equilibrium.  The ΔcGUPPI for PAC  can be negative

when side payments are impossible. The identity and incentives of the firm that is least willing to

jointly raise prices can be different post-merger, as shares and diversion ratios reflect the new

post-merger ownership.