Vertical mergers can raise a variety of competitive concerns, including foreclosure, coordination, and misuse of sensitive competitive information. One key concern is input foreclosure. Input foreclosure involves raising the costs of competitors in the downstream market. 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. 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. These effects could lead the downstream firms to raise prices and harm consumers.

1 Input foreclosure is different from customer foreclosure, which involves reducing sales opportunities, and hence the revenues, of the upstream input competitors by denying them the ability to sell inputs to the downstream merging firm. For a discussion of both foreclosure concepts 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). For other analyses of vertical mergers, see Jeffrey Church, Vertical Mergers, in 2 ABA SECTION OF ANTITRUST LAW, ISSUES IN COMPETITION LAW AND POLICY 1455 (W. Dale Collins ed., 2008); Michael H. Riordan, Competitive Effects of Vertical Integration, in HANDBOOK OF ANTITRUST ECONOMICS 145 (Paolo Buccirossi ed., 2008), and the sources cited therein. See also European Commission, Guidelines on the Assessment of Non-horizontal Mergers Under the Council Regulation on the Control of Concentrations Between Undertakings, 2008 O.J. (C 265) 6 [hereinafter EC Non-Horizontal Merger Guidelines]. For a general framework, see Thomas G. Krattenmaker & Steven C. Salop, Anticompetitive Exclusion: Raising Rivals’ Costs to Achieve Power over Price, 96 YALE L.J. 209 (1986).

2 A similar concern applies to complementary product mergers. The merger may lead the merged firms to refuse to deal with or raise the unbundled prices of the complements to competitors that are not integrated.
Vertical mergers also can increase competition by the creation of efficiencies. Vertically related firms must cooperate to some degree to bring products to market. This creates greater opportunities for efficiency gains than for horizontal mergers. These efficiencies can involve the creation of superior products and lower costs. The most well-known efficiency benefit is the elimination of double marginalization (EDM). This efficiency occurs when the merger allows the downstream firm to acquire the upstream merger partner’s input at an effective transfer price equal to marginal cost. This gives the downstream merging firm an incentive to reduce the prices of its products after the merger, other things held constant.

Merger-specific EDM is not inevitable, however, because the downstream merging firm may be locked in to inputs provided by other firms or it may be able to pay a price equal to marginal cost absent the merger. However, where merger-specific EDM does occur, it can offset the incentives to raise the prices of the upstream and downstream merging firms.

In this article, we explain how the upward (or downward) pricing pressure resulting from unilateral incentives following a vertical merger can be scored with vertical gross upward pricing pressure indices (vGUPPIs). 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. The vGUPPIs provide more direct evidence on unilateral pricing incentives than other metrics commonly used in vertical merger cases, such as concentration indices and foreclosure rates. They also are simpler to implement and require

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3 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 E.C. Non-Horizontal Merger Guidelines, supra note 1, ¶¶ 13–14; see also Riordan & Salop, supra note 1, at 522–23; Church, supra note 1, at 1461–63.

4 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 § 4.2 (1988). EDM can also occur for complementary product mergers.

5 The downstream merging firm may pay 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. The merged firm also may have the incentive to transfer inputs internally at price above marginal cost. See Riordan & Salop, supra note 1; 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).

6 The analysis of vGUPPIs also clarifies the proper measurement of foreclosure rates, including the impact of input substitution.
less data than merger simulation models. Thus, when the U.S. Non-Horizontal Merger Guidelines are revised, the vGUPPIs can be used to help gauge incentives.

The vGUPPI methodology follows the same basic methodology as the horizontal merger GUPPIs, which were adopted in the 2010 Horizontal Merger Guidelines as a metric for scoring unilateral effects concerns in horizontal mergers. These horizontal merger GUPPIs gauge the post-merger incentives for unilateral price increases by the merged firm. The GUPPIs measure only the “first round” incentives, in that they do not take into account several feedback effects, including the incentives of non-merging firms to respond to the merger by changing their prices, by repositioning their products, or by further entry. Nor do the GUPPIs take into account the impact of merger-induced efficiencies on pricing incentives.

There are several advantages to using vGUPPIs. First, vGUPPIs are “incentive scoring devices” that are premised on the assumption that firms are rational, profit-maximizing entities, an assumption that remains at the core of antitrust. The economic incentives of the firms provide relevant information about the likely outcomes of combinations. While incentive scoring is not the

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7 For simulation models for vertical mergers, see Kenneth Hendricks & R. Preston McAfee, *A Theory of Bilateral Oligopoly*, 48 Econ. Inquiry 391 (2010); Michael A. Salinger, *Vertical Mergers and Market Foreclosure*, 103 Q.J. Econ. 345 (1988). 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 assume homogeneous products both upstream and downstream, whereas many vertical mergers involve firms that produce differentiated products. (In contrast, the vGUPPIs developed in this article are based on a model with product differentiation both upstream and downstream.) For further discussion on merger simulation models, see Francine Lafontaine & Margaret Slade, *Vertical Integration and Firm Boundaries: The Evidence*, 45 J. Econ. Literature 629 (2007).


only information relevant for evaluating likely effects, it clearly is useful evidence. Indeed, incentive scoring methodologies are particularly useful when compared to simple structural measures, such as the HHI or other concentration indices.11

Second, the vGUPPIs have the related advantage that they do not require markets to be defined in advance. While market definition is simple in some matters, it raises contentious issues in others.12 The vGUPPIs can be calculated from observable data and variables that often can be roughly estimated, so they can be used as part of a preliminary analysis to screen vertical mergers that raise input foreclosure or output reduction concerns. The vGUPPI estimates then can be refined as more data is collected and more analysis can be done.

Third, the “vertical arithmetic” methodology currently used to gauge foreclosure concerns has certain limitations.13 The vertical arithmetic evaluates the incentive for non-price rationing, but foreclosure concerns often focus on the use of price to foreclose. These are not equivalent methodologies because it generally is more profitable to foreclose by raising price than by refusing to

11 Three different “vertical HHI” measures have been proposed in the economic 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. Furthermore, the HHI is not directly related to unilateral pricing incentives. 2010 Guidelines, supra note 9, § 6.1; see also 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 359; Joseph Farrell & Carl Shapiro, Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition, B.E. J. THEOR. ECON., vol. 10, no. 1, art. 9, at 23 (2010), http://www.bepress.com/bejte/vol10/iss1/art41.

12 In these cases, the variables used in vGUPPI and GUPPI analysis also are used in market definition analysis and there is a close relationship between GUPPIs and the SSNIP test for market definition. Under linear demand, a GUPPI higher than 10% implies a price increase larger than 5%. Therefore, in horizontal merger cases in which both GUPPIs are higher than 10%, one could define a narrow market that includes only the products of the merging firms, and view the proposed transaction as constituting a “merger to monopoly.” See Serge Moresi, The Use of Upward Price Pressure Indices in Merger Analysis, ANTITRUST SOURCE, Feb. 2010, http://www.abanet.org/antitrust/at-source/10/02/Feb10-Moresi2-25f.pdf.

deal or using non-price means to raise competitors’ costs. In addition, the vertical arithmetic methodology does not take into account the effects of merger-specific EDM or gauge the direct impact of the merger on the pricing incentives of the downstream merging firm. However, for gauging input foreclosure concerns, the tests are related. The vertical arithmetic can be expressed as a vGUPPI test with a specific safe harbor.

The vGUPPIs measure economic incentives. A vertical merger can create unilateral incentives for the upstream merging firm to raise the prices of its inputs to the competitors of the downstream merger partner and also can create unilateral incentives for the downstream merging firm to reduce prices as a result of vertical efficiencies, particularly EDM. These are the central incentives driving input foreclosure concerns and efficiency rationales in vertical merger cases.

Our analysis also identifies an additional incentive effect—a vertical merger also might give the downstream merging firm a unilateral incentive to raise its price above the pre-merger level (all else equal). By doing so, its sales would decrease. However, if consumer substitution increases the sales of competitors that use the inputs supplied by the upstream merger partner, the profits of the upstream merger partner would rise. Pre-merger, the downstream firm does not take into account this positive effect on the upstream firm, but it would do so post-merger.

We derive three vGUPPI scores: a vGUPPIu for the pricing incentives of the upstream merging firm, a vGUPPId for the pricing incentives of the downstream merging firm, and a vGUPPIr for the pricing incentives of the targeted downstream rivals. The vGUPPIr results from the vGUPPIu. While GUPPIs are designed to be “gross” measures that do not take efficiencies into account, it might be argued that EDM should be incorporated into the vGUPPI methodology on the grounds that it is an inherent efficiency benefit in vertical mergers. To address this point, we have extended the methodology to derive vGUPPId measures that adjust for EDM. This adjustment reduces the level of the vGUPPId and can even lead to a negative value, that is, a first-round incentive to reduce the price of the downstream output of the merged firm.

The fact that the two merging firms operate at different levels in the vertical chain of production adds a complexity to the interpretation of the vGUPPIs. 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 (or reduce) its output price post-merger. This is important because 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). To take an extreme 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.\footnote{This was the type of allegation (without the quantification) underlying the Ford Autolite vertical merger complaint. See, e.g., Ford Motor Co. v. United States, 405 U.S. 562 (1972).} 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.

This analysis shows the relevance of the upward pricing incentives of the downstream rival or rivals whose costs are increased, as measured by the $vGUPPI_r$. The $vGUPPI_r$ score provides a better measure than the $vGUPPI_u$ of the upward pricing pressure that the targeted downstream rivals would have post-merger. The $vGUPPI_r$ together with the $vGUPPI_d$ provide evidence of the upward pricing pressure in the output market.

At the same time, it is important to recognize the limitations of the $vGUPPI$s. First, like the horizontal merger GUPPIs, the $vGUPPI$s are based on diversion ratios, price-cost margins and price ratios.\footnote{In fact, the $vGUPPI_u$ and $vGUPPI_r$ (which score the pricing incentives of the upstream merging firm and the targeted downstream competitor) are related to the horizontal GUPPI for a hypothetical merger of the downstream merging firm and the targeted competitor. When there is input substitution, the relationship is more complex.} The $vGUPPI$s, however, are somewhat more complex than the horizontal GUPPIs.\footnote{The $vGUPPI_r$ also depends on the rate at which upstream cost increases are passed through into input price increases. The importance of the upstream merging firm’s input in the costs of the downstream firms also is a relevant factor for calculating the $vGUPPI$s.} This added complexity would complicate the use of the $vGUPPI$s as a simple initial screen, rather than as part of a full competitive effects analysis.

Second, like the horizontal GUPPIs, the $vGUPPI$s do not by themselves comprise a complete competitive effects analysis. Instead, they gauge only first-round incentives to raise prices. The $vGUPPI$s do not take into account pricing feedbacks between the two merging firms.\footnote{GUPPI analysis for horizontal mergers can be extended to account for feedback effects between the two merging firms. See Jerry Hausman, Serge Moresi & Mark Rainey, \textit{Unilateral Effects of Mergers with General Linear Demand}, 111 Econ. Letters 119 (2011); Carl Shapiro, \textit{Mergers with Differentiated Products}, Antitrust, Spring 1996, at 23; Gregory J. Werden, \textit{A Robust Test for Consumer Welfare Enhancing Mergers Among Sellers of Differentiated Products}, 44 J. Indus. Econ. 409 (1996).} They also ignore any effect of the merger on the incentives of other input suppliers to change their prices in response to the merger-induced price changes by the merged firm. Accounting for those effects could have a significant impact on the upward pricing pressure placed on the targeted rivals.\footnote{For example, an input price increase by the upstream merging firm might induce suppliers of substitute inputs to raise price as well, which would lead to greater upward pricing pressure.} The $vGUPPI$s also do not take...
into account pricing reactions of downstream rivals, except for the downstream rivals that are targeted with an input price increase. They also do not take into account the offsetting impact of supply-side factors (e.g., entry and repositioning) and merger-specific efficiencies other than EDM, or the impact of EDM and other efficiencies on the pricing incentives of other input suppliers. Thus, the vGUPPIs are used in conjunction with other evidence of competitive effects and efficiencies in a full competitive effects analysis.

The remainder of the article is organized as follows. Part I provides the basic analytic framework and presents the vGUPPI formulas for the case with no input substitution. Part II extends the analysis to the case with input substitution. These two sections also provide several examples illustrating how to apply and calculate the vGUPPIs. Part III carries out further policy analysis, including the issue of possible vGUPPI safe harbors. Part IV compares the vGUPPI methodology to the vertical arithmetic methodology that has been used to score foreclosure concerns in vertical mergers. Part V concludes with a discussion of the incentive scoring approach and other possible GUPPI metrics that might be developed. A Glossary follows. An Appendix that describes the formal economic model underlying the vGUPPIs and provides technical details for several formulas is available at http://www.americanbar.org/content/dam/aba/publishing/antitrust_law_journal/at_alj_moresi_salop.pdf.

I. BASIC ANALYTICS OF vGUPPIs

The basic GUPPI methodology can be applied to vertical mergers. There are vGUPPIs for input foreclosure and output reduction concerns. There are three vGUPPIs: a $vGUPPI_u$ for the input pricing incentives of the upstream merging firm in selling inputs to a targeted downstream rival; a $vGUPPI_r$ for the pricing incentives of the foreclosed downstream rival; and a $vGUPPI_d$ for the pricing incentives of the downstream merger partner.

For simplicity of analysis and exposition, we will assume that each input supplier produces a single input and each output manufacturer purchases inputs from several suppliers. These suppliers produce a specific type of input, such as, for example, chemical products for use as catalysts in the production process used by the downstream firms, or operating systems for mobile devices. In addition, each manufacturer also uses other types of inputs, such as labor and capital. We assume that the merger has no effect on the prices of these other inputs.

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). For a different example, EDM might lead the downstream merging firm to reduce the price of its output, which would tend to reduce the upstream merging firm’s incentive to engage in input foreclosure. See Salop et al., DIRECTV, supra note 13, app. B.
We generally will assume that the relevant inputs and the downstream products are differentiated products (i.e., imperfect substitutes). This assumption is typically made for unilateral effects GUPPI analysis. We also will assume that each input supplier can charge different prices to its various customers (i.e., the downstream manufacturers). This permits analysis of the impact of a vertical merger on the incentives of the merged firm to raise the price it charges for its input to each downstream competitor separately.

The simplest scenario occurs where there is no further ability for firms to substitute between the inputs sold by the upstream merging firm and other inputs following an input price increase by the upstream merging firm. This explicates the basic analysis, which then can be refined to account for the input substitution.

A. vGUPPIu: vGUPPI for the Upstream Merging Partner’s Price

A vertical merger can have an impact on the incentives of the merged firm to raise the price of the input that it sells to one or more specific targeted downstream rivals. The vGUPPIu scores the first-round incentive of the merged firm to raise the price it charges for its input to each targeted manufacturer. Because input suppliers can charge different prices to different cus-

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19 Product differentiation includes minor differences in delivery speed, return privileges, customer service, and warranties, as well as technical product differences. When perfect substitution leads to price equal to marginal cost, the vGUPPIs will equal zero.

20 We also make the following technical assumptions. First, the input suppliers simultaneously set their prices to each manufacturer to maximize profits. Second, the downstream manufacturers simultaneously set their output prices to maximize profits. Third, when a downstream manufacturer sets its price, it does not observe the prices that the input suppliers are charging to the other manufacturers. The details of the formal economic model and the derivation of the vGUPPIs are set out in the Appendix, available at http://www.americanbar.org/content/dam/aba/publishing/antitrust_law_journal/antitrust_law_journal_at_alj_moresi_salop.pdf.

21 The “single monopoly profit” theory (that there is a single monopoly profit that can be achieved in the absence of vertical integration) would not apply, except under very limited circumstances. This is the case even if the input of the upstream merging firm is used in fixed proportions with other inputs, so that the upstream merging firm is a monopolist for the relevant input. In particular, the theory does not apply if the downstream firms sell differentiated products. For example, suppose that the upstream merging firm is the only supplier of the relevant input to a rival of the downstream merging firm and, for simplicity, that the downstream merging firm does not use that input. Suppose further that the downstream firms sell differentiated products. In this case, the upstream merging firm would charge the downstream rival the monopoly input price pre-merger, and it would raise that price further post-merger. This is because the input price increase would induce the downstream rival to raise the price of its products and thus allow the downstream merger partner to earn higher profits. (The formal proof involves a simple economic argument. For a small input price increase, the profit loss of the upstream merging firm is of second-order magnitude, while the profit gain of the downstream merger partner is of first-order magnitude. See Riordan & Salop, supra note 1, at 566 (fig. A-1).)
tomers, there is a separate vGUPPlu for each downstream competitor that might be targeted.22

The vGUPPlu can be explained using the same economics principles as in the 2010 Merger Guidelines, with the language adjusted to account for the vertical nature of the merger:

Adverse [input] price effects can arise when the [vertical] merger gives the merged entity an incentive to raise the price of [the input] previously sold by [the upstream] merging firm [to a rival of the downstream merging partner] and thereby divert sales [of the downstream rival] to products previously sold by the [downstream] merging firm, boosting the profits on the latter products. Taking as given other prices and product offerings, that boost to profits is equal to the value to the merged firm of the sales diverted to those products. The value of sales diverted to a product is equal to the number of units diverted to that product multiplied by the margin between price and incremental cost on that product. . . . If the value of diverted sales is proportionately small, significant [input] price effects are unlikely.23

The Guidelines further explain that the GUPPI can be calculated as follows:

For this purpose, the value of diverted sales is measured in proportion to the lost revenues attributable to the reduction in unit sales resulting from the [input] price increase. Those lost revenues equal the reduction in the number of units sold of [the input] multiplied by [the price of the input].24

Applying this same methodology to vertical mergers, one would calculate the vGUPPlu as follows:

\[ vGUPPlu = \frac{\text{value of sales diverted to downstream merging partner}}{\text{revenue on volume lost by upstream merging partner}} \]

The formula for the vGUPPlu is the following:

\[ vGUPPlu = DR_{UD} \times M_D \times P_D / W_R \] (1)

where \( DR_{UD} \) denotes the “vertical” diversion ratio from the upstream merging firm (U) to the downstream merger partner (D), following a unilateral increase in the input price charged to the targeted downstream rival (R) under consideration,25 \( M_D \) denotes the downstream merger partner’s percentage incremental

22 For each targeted downstream competitor, the derivation of vGUPPlu holds all the other prices constant, except for the output price of the downstream competitor that is subject to the input price increase. We analyze below (in Part 1.D) the extension of the vGUPPlu formula to account for the fact that the input prices charged to other targeted rivals also would rise.

23 See 2010 Guidelines, supra note 9, § 6.1.

24 Id. at 21 n.11.

25 Specifically, \( DR_{UD} \) is the volume of output gained by Firm D, expressed as a fraction of the volume of input sales to Firm R lost by Firm U. This definition and others are summarized in the Glossary.
profit margin. The dollar incremental profit margin of the downstream merging firm is equal to $P_D - C_D$, where $C_D$ denotes the firm’s marginal cost of production (including the costs of all other types of inputs). The corresponding percentage profit margin is given by $M_D = (P_D - C_D) / P_D$. The margins of the upstream merging firm and the targeted downstream competitor, $M_U$ and $M_R$, are defined in a similar way, except that for the upstream merging firm the margin can vary across customers.

27 Diversion ratios, margins and prices are evaluated at their pre-merger values. Equation (1) 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).

28 Similarly, every horizontal merger raises the HHI.

29 For each downstream firm, we choose measurement units for output and input so that the number of units of input purchased from the upstream merging firm is equal to the number of units of output produced. See supra note 27. We also assume constant returns to scale.
firm will capture 40 out of those 100 units. Thus, the diversion ratio $DR_{UD}$ from the upstream merging firm to the downstream merger partner also is equal to 40%. Suppose the margin $M_D$ of the downstream merger partner is equal to 50%, and the output price of the downstream merger partner is twice the input price per unit of output paid by the targeted rival to the upstream merging firm, i.e., $P_D/W_R = 2$. Equation (1) then yields $v_{GUPPIu} = 40\%$ (i.e., $0.4 \times 0.5 \times 2$).

This illustrative example shows that a vertical merger can create a substantial incentive to raise the price of the input to a targeted competitor. The $v_{GUPPIu}$ is smaller if the margin and diversion ratios are smaller. For example, if $M_D = 25\%$ and $DR_{UD} = 20\%$, then $v_{GUPPIu} = 10\%$. If the price of the input represents a small fraction of the price of the output, the $v_{GUPPIu}$ could be very large. For example, if the input/output price ratio were 20 instead of 2, then the $v_{GUPPIu}$ in the latter example would rise from 10% up to 100%. This latter point raises the issue of whether one should also score the upward pricing pressure on the output price of the targeted rival (that is implied by the upward pricing pressure on the input price).

**B. $v_{GUPPIr}$: IMPLIED $v_{GUPPI}$ FOR THE FORECLOSED RIVAL’S PRICE**

An increase in the upstream merging firm’s 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 suggests the relevance of the upward pricing incentives of the downstream rival whose costs would be raised post-merger. The $v_{GUPPIr}$ 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. Thus, the $v_{GUPPIr}$ is derived from $v_{GUPPIu}$.

There are two main benefits to calculating the $v_{GUPPIr}$. First, the $v_{GUPPIr}$ is a better predictor than $v_{GUPPIu}$ of the potential impact of the vertical merger on the customers of the targeted downstream rival. Second, the $v_{GUPPIr}$ is comparable to the $v_{GUPPId}$ for the output price of the downstream merging firm, as described in the next section. This is important be-

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30 Assuming linear demand, a $v_{GUPPIu}$ of 40% corresponds to a (first-round) input price increase of 20% charged to the targeted rival. Specifically, a $v_{GUPPIu}$ of 40% means that the merged firm would have the same incentive to raise the input price to the targeted downstream rival as the upstream merging firm would have pre-merger if its marginal cost of supplying inputs to that firm increased by an amount equal to 40% of the input price. Translating this upward pricing pressure index into a corresponding increase in the input price requires information about the cost pass-through rate of the upstream merging firm. When demand is linear, the cost pass-through rate equals 50% (all else equal) and thus a $v_{GUPPIu}$ of 40% corresponds to an input price increase of 20%. We use this 50% pass-through rate as a default, absent contrary evidence in a specific case.
cause, in some cases, a vertical merger might create upward pricing pressure upstream and downward pricing pressure downstream. Assessing the net effect of the merger by combining a positive $vGUPPIu$ and a negative $vGUPPl_d$ is likely to be difficult because $vGUPPIu$ pertains to the upstream price of the input, while $vGUPPl_d$ pertains to the downstream price of the output. However, combining a positive $vGUPPl_r$ and a negative $vGUPPl_d$ is easier because both pertain to downstream prices.

The formula for the $vGUPPl_r$ is the following: $vGUPPl_r = vGUPPIu \times PTR_u \times W_R / P_R$ (2)

where $PTR_u$ denotes the cost pass-through rate of the upstream merging firm and $P_R$ denotes the price of the output sold by the targeted downstream rival.

**Example 2: $vGUPPl_r$ when there is no input substitution**

Consider again Example 1 above, in which the $vGUPPIu$ equals 40%. Suppose the upstream pass-through rate $PTR_u$ is equal to 50%. 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 twice the input price per unit of output charged to the targeted rival, which implies $W_R / P_R = 0.5$. In this example, therefore, equation (2) yields $vGUPPl_r = 10\%$ (i.e., $0.4 \times 0.5 \times 0.5$).

Example 2 illustrates the fact that $vGUPPl_r$ can be substantially lower than $vGUPPIu$ (i.e., 10% versus 40%). The difference is largest when the price of the input per unit of output represents a small fraction of the price of the output. For example, if the input/output price ratio in Examples 1 and 2 is 0.1 instead of 0.5, the $vGUPPIu$ rises to 200%, as calculated above, while the $vGUPPl_r$ remains equal to 10%. This suggests that the $vGUPPIu$ might be a

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31 The derivation of equation (2) is as follows. The $vGUPPIu$ corresponds to a percentage input price increase (to the targeted downstream rival) equal to $vGUPPIu \times PTR_u$, where $PTR_u$ is the cost pass-through rate of the upstream merging firm. See supra note 30. Thus, the nominal input price increase is equal to $vGUPPIu \times PTR_u \times W_R$. The $vGUPPl_r$ is equal to this increase in the targeted rival’s marginal cost of production, expressed as a percentage of the price of the targeted rival’s output. (Translating the $vGUPPl_r$ into a corresponding output price increase would require information as to the cost pass-through rate of the targeted rival manufacturer.)

32 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).

33 The $vGUPPl_r$ 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 $vGUPPl_r = GUPPl_r \times PTR_u$, where $GUPPl_r = DR_{RD} \times M_{RD} \times P_D / P_e$.

34 This result follows from linear demand and is commonly used in discussing horizontal GUPPIs.
less useful screen than the $vGUPPr$ for scoring potential input foreclosure concerns.

C. $vGUPPId$: vGUPPI for the Downstream Merging Partner’s Price

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 upward pricing pressure 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. This is the EDM effect. 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.

We first consider a scenario that does not reckon EDM into the $vGUPPId$. This scenario is appropriate when EDM is not found to be merger-specific. We refer to the vGUPPI measure for this scenario as $vGUPPId1$. Following again the GUPPI methodology described in the 2010 Merger Guidelines, we calculate $vGUPPId1$ as follows:

$$vGUPPId1 = \frac{\text{value of sales diverted to upstream merging partner}}{\text{revenue on volume lost by downstream merging partner}}$$

which yields a positive number for $vGUPPId1$ that can be written as:

$$vGUPPId1 = DR_{DU} \times MU \times WU / PD$$

(3)

where $DR_{DU}$ denotes the vertical diversion ratio from the downstream merging firm to the upstream merger partner, $WU$ and $MU$ 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 $PD$ denotes the downstream merger partner’s output price.

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35 See supra note 5.
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 percentage” (or “aggregate diversion ratio”) following a unilateral price increase by the downstream merging firm.\footnote{The market recapture percentage 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 Guidelines, supra note 9, § 4.1.3, use the market recapture percentage in the context of market definition.} This can be illustrated with the following example.

**Example 3: $vGUPPId$ when there is no EDM**

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 percentage 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 $M_U$ of 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 downstream merger partner, i.e., $W_U / P_D = 0.50$. From equation (3), $vGUPPId1 = 6.25\%$ (i.e., $0.25 \times 0.50 \times 0.50$).

In this analysis, the input prices of the upstream merger partner are held constant at the pre-merger level. Thus, $vGUPPId1$ scores the first-round incentive to raise the output price of the downstream merging firm before any increase in the input price charged to any targeted downstream rivals. Specifically, it does not take into account the impact of raising rivals’ costs on the pricing incentives of the downstream merging firm.

The $vGUPPId1$ also does not take into account any potential downward pricing pressure from merger-specific EDM. Accounting for EDM will reduce the $vGUPPId$ and possibly make it negative. Suppose that the downstream merging firm is unable to substitute away from inputs purchased from rival suppliers with inputs from the upstream merger partner. Even here, merger-specific EDM could reduce its marginal cost. This leads to the following formula, which we denote as $vGUPPId2$:

$$vGUPPId2 = vGUPPId1 - M_{UD} \times W_D / P_D$$

(4)
where \( v_{GUPPl} \) is given in equation (3), and \( M_{UD} \) and \( W_D \) denote the margin and price of the upstream merging firm on input sales to the downstream merging firm.

Equation (4) implies that if market demand is perfectly price inelastic and downstream firms are symmetric, then \( v_{GUPPl2} = 0 \). (The downstream firms are symmetric if each of them purchases the input of the upstream merging firm and if the upstream merging firm earns the same dollar margin on input sales to each downstream firm.) 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., \( v_{GUPPl2} = 0 \).  

In fact, if instead market demand is not perfectly inelastic (or if some downstream firms are not customers of the upstream merging firm) and there is symmetry among the customers of the upstream firm, then \( v_{GUPPl2} < 0 \) and there is a strict incentive for the downstream firm to reduce its price. For example, consider again Example 3 where \( v_{GUPPl1} = 6.25\% \). 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, \( v_{GUPPl2} = -18.75\% \) (i.e., \( 0.0625 - 0.5 \times 0.5 \)). This is 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 downward pricing pressure on the downstream merging firm, ceteris paribus.

In short, merger-specific EDM can make a substantial difference to the analysis, even if there is no potential for input substitution. If \( v_{GUPPl} < 0 \), it will mitigate and possibly reverse the impact of \( v_{GUPPlr} > 0 \), 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 \( v_{GUPPlr} \) and \( v_{GUPPld} \).

\[ \text{Formally, zero market elasticity and symmetry imply } DR_{de} = 1, W_e = W_d \text{ and } M_e = M_d. \]
Equations (3) and (4) then imply \( v_{GUPPl2} = 0 \).  

A different approach might be to construct a full-blown vertical merger simulation model. See supra note 7.
D. MULTIPLE TARGETED DOWNSTREAM Rivals

The vGUPPIu and vGUPPIr analyzed above evaluated the merged firm’s incentives to raise the input prices charged to downstream rivals “one at a time.” That is, for each targeted downstream competitor, the vGUPPIu formula was derived holding the input prices charged to any other targeted competitors constant at their pre-merger level. This is a conservative approach because the incentive to raise the input price to any given targeted rival is higher if the merged firm simultaneously raises price also to other rivals.

This is an important issue because the merged firm may have the incentive to foreclose multiple firms simultaneously, which can significantly increase the profitability and the incentives to raise input prices further. Relying solely on the vGUPPIu (or the vGUPPIr) calculated for a targeted price increase to a single rival can ignore significant interaction effects from simultaneous price increases and, therefore, lead to significant under-prediction of adverse effects.40

The vGUPPIu and vGUPPIr formulas can be extended to account for these interaction effects. When the merged firm raises the input price to multiple downstream rivals, there is more diversion to the downstream merger partner (than when it raises the input price to just one rival). For example, suppose that the upstream firm were to raise the input prices simultaneously to all its downstream rivals. If so, then a greater percentage of the sales lost by each rival would be diverted to the downstream merger partner because the downstream merger partner would be the only firm that did not experience a price increase. This analysis can be illustrated with the following example.

Example 4: Simultaneously targeting multiple downstream rivals

Consider again Examples 1 and 2 above in which the diversion ratio between the targeted downstream rival and the downstream merger partner was equal to 40%. That is, if the merged firm raises the input price to that rival only, the downstream merger partner captures 40% of the output that the rival loses as the result of the input price increase. Given the margin and price data

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40 The same issue arises in horizontal merger cases involving multi-product firms, if the GUPPIs for the multiple products sold by one merging firm are calculated separately for each product and one at a time. It is noteworthy that the Guidelines seem to instruct practitioners to evaluate the upward pricing pressure for each individual product separately. See 2010 Guidelines, supra note 9, § 6.1 (“Adverse unilateral price effects can arise when the merger gives the merged entity an incentive to raise the price of a product previously sold by one merging firm and thereby divert sales to products previously sold by the other merging firm, boosting the profits on the latter products.”) (emphasis added). However, the Guidelines do not indicate whether the upward pricing pressure for each individual product sold by the same merging firm should be evaluated one at a time or simultaneously (i.e., whether the other prices charged by that firm should be held constant at their pre-merger level or should be assumed to rise as well).
in these examples, the $\nu_{GUPPIu}$ and $\nu_{GUPPIr}$ were 40% and 10%, respectively. Suppose there is an identical second rival that also purchases the input of the upstream merging firm and thus also can be targeted for input foreclosure by the merged firm. One conservatively could apply the same $\nu_{GUPPI}$s of 40% and 10% to the second targeted rival as well. However, if the merged firm raises the input price to both rivals simultaneously, suppose the downstream merger partner would capture 50% of the sales lost by the two rivals.\footnote{This is consistent with a 20% diversion ratio between the two targeted rivals. As a general matter, if all the targeted downstream rivals are symmetric, so that the input price increases would be the same for each targeted rival and each targeted rival would have the same incentive to raise its own price, and if the downstream firms face linear demand, then the $\nu_{GUPPIu}$ and $\nu_{GUPPIr}$ can be calculated by replacing the standard diversion ratio $\text{DR}_{\text{unilateral}}$ for a single targeted rival (calculated holding the prices of other targeted rivals constant) with the “overall” diversion ratio $\text{DR}_{\text{overall}} = \text{DR}_{\text{unilateral}} / (1 - \text{DR}_{\text{aggregate}})$, where $\text{DR}_{\text{aggregate}}$ denotes the aggregate diversion ratio from a targeted rival to all the other targeted rivals (following a unilateral price increase by a targeted rival). For example, suppose there are three targeted rivals and, if any one of them were to raise price unilaterally and lose 100 units of sales, then the downstream merging firm would capture 30 units (i.e., $\text{DR}_{\text{unilateral}} = 30\%$) and each of the other two targeted rivals would capture 20 units (i.e., $\text{DR}_{\text{aggregate}} = 40\%$). (The remaining 30 units would be diverted to non-targeted rivals and outside goods.) With linear demand, if all three targeted rivals simultaneously raise price equally, then each of them loses 100 units “initially” and then recaptures 40 units when the other two targeted rivals also raise price. Thus, the three targeted rivals lose a total of 180 units when they raise price simultaneously. The downstream merging firm captures 90 units (i.e., 30 units from each targeted rival) and thus the overall diversion ratio equals 50% (i.e., 90/180). That is, $\text{DR}_{\text{overall}} = \frac{\text{DR}_{\text{unilateral}}}{1 - \text{DR}_{\text{aggregate}}} = \frac{0.3}{1 - 0.4} = 0.5$.}

This increase in the diversion ratio from 40% to 50% leads to an increase in the $\nu_{GUPPIu}$ from 40% to 50% and a corresponding increase in the $\nu_{GUPPIr}$ from 10% to 12.5%.

II. ACCOUNTING FOR INPUT SUBSTITUTION

The basic analysis above assumes that there is no ability for downstream rivals to substitute away from the input sold by the upstream merging firm if it raises its price. As a result, the only constraint on the upstream firm’s incentive to raise prices is the fact that higher input prices will lead to higher output prices, which will choke off demand for the products of the targeted firms and the inputs that they require. The lack of input substitution also limited the magnitude of potential merger-specific EDM.

The analysis changes when there is a potential for input substitution.\footnote{Formal analysis is provided in the Appendix, available at http://www.americanbar.org/content/dam/aba/publishing/antitrust_law_journal/at_alj_moresi_salop.pdf.} When downstream firms have access to production technologies that permit them to substitute away from the input of the upstream merging firm to other suppliers, the market power of the upstream merging firm will be lessened, both before and after the merger. This substitution will mitigate (or possibly even eliminate) the cost increase and the associated increase in the price of the targeted firm’s output. As a result, diversion to the downstream merging firm...
from the input price increase also will be reduced. These effects will reduce the incentive to engage in input foreclosure, perhaps very substantially. This input substitution can be reckoned into the vGUPPI analysis.

A. vGUPPI

In the presence of input substitution, the vGUPPI formula is given as follows:

$$vGUPPIu = \frac{DR_{RD} \times M_R \times P_D / W_R}{1 + M_R \times \frac{ESR}{EP}}$$  \hspace{1cm} (5)$$

The numerator in equation (5) is the vGUPPI in the absence of input substitution, and the denominator is the adjustment to be made to account for input substitution. Since the denominator exceeds unity, input substitution tends to reduce the vGUPPI (all else equal). The magnitude of the denominator—and the incentive to raise the input price to the targeted rival—depends on two elasticities, $ESR$ and $EP$; $ESR$ measures the extent to which the targeted rival can substitute away from the upstream merging firm’s input to other input suppliers; $EP$ measures the extent to which the targeted rival passes through an increase in the upstream merging firm’s input price into its output price.

**Example 5: vGUPPI when there is input substitution**

Consider again the assumptions of Example 1. If there is no input substitution ($ESR = 0$), the vGUPPI equals 40% (i.e., the numerator in equation (5) equals 40%). Suppose instead that there is input substitution and assume $ESR = 2.5$, $EP = 0.25$ and $M_R = 50%$. Thus, the denominator in equation (5) equals 6 (i.e., $1 + 0.5 \times 2.5 / 0.25$). It follows that input substitution reduces the vGUPPI from 40% to about 6.7% (i.e., 40% divided by 6). This shows the large impact that input substitution can have on the incentive to raise post-merger input prices.

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$$43$$ We will discuss the estimation and the properties of these elasticities in Part II.D below.

$$44$$ We use $S_{UR}$ to denote the upstream merging firm’s share of the targeted rival’s total purchases of the relevant input. This share pertains to the relevant inputs under consideration (e.g., chemical products used as catalysts) and ignores all other types of inputs (e.g., other chemicals, labor, and fuel). $ESR$ denotes the elasticity of $S_{UR}$ with respect to an increase in the input price $W_R$ that the upstream merging firm charges to the rival. For example, suppose a supplier raises the price of its input to a manufacturer by 10% and, as a result of the input price increase, the supplier’s share of the manufacturer’s total input purchases falls by 25%, say from 60% to 45%. In this example, $ESR$ would equal 2.5 (i.e., 25% divided by 10%).

$$45$$ $EP$ denotes the elasticity of the price of the targeted rival ($P_D$) with respect to an increase in the input price that the rival must pay to the upstream merging firm ($W_R$). For example, suppose a supplier raises the price of its input to a manufacturer by 10% and, as a result of the input price increase, the manufacturer raises the price of its output by 2.5%. In this example, $EP$ would equal 0.25 (i.e., 2.5% divided by 10%).
Despite the additional complexity created by input substitution, the signs of the various terms in equation (5) make intuitive sense. A higher value of $E_{SR}$ implies that the targeted rival will substitute a larger share of inputs previously purchased from the upstream merging firm with purchases from other suppliers (as opposed to raising its output price) and thus implies that the merged firm will have a weaker incentive to raise the input price to the targeted rival. Conversely, a higher value of $E_P$ implies that the targeted rival will have an increased propensity to pass through an input price increase in its output price (as opposed to substituting input purchases from the upstream merging firm with input purchases from other suppliers) and thus implies that the merged firm will have a stronger incentive to raise the input price to the targeted rival. Finally, a higher value of $M_R$ implies that the targeted rival faces a more inelastic demand and, therefore, the targeted rival loses fewer sales when it raises its output price in response to an input price increase. This in turn implies that the volume of sales diverted from the foreclosed rival to the merger partner is smaller, and hence the merged firm will have a weaker incentive to raise the input price to the targeted downstream rival.

B. $v_{GUPPIr}$

When there is input substitution, the $v_{GUPPIr}$ formula is given as follows:

$$v_{GUPPIr} = v_{GUPPIu} \times \frac{PTR_u}{P_R} \times \frac{S_{UR}^{post}}{S_{UR}}$$

(6)

where $v_{GUPPIu}$ is given in equation (5) and:

$$\frac{S_{UR}^{post}}{S_{UR}} = 1 - v_{GUPPIu} \times PTR_u \times E_{SR}$$

(7)

These two equations show that input substitution has two effects that tend to reduce the $v_{GUPPIr}$. First, as indicated by equation (7), the fraction $S_{UR}^{post} / S_{UR}$ is smaller than unity and accounts for the fact that the targeted rival would respond to an increase in the input price by reducing the share of its input purchases from the upstream merging firm.\(^{46}\) Second, the value of $v_{GUPPIu}$ in equation (6) is smaller when there is input substitution, which accounts for the fact that the input price increase by the upstream merging firm would be smaller to begin with.

**Example 6: $v_{GUPPIr}$ when there is input substitution**

Consider again Example 5 where input substitution reduces $v_{GUPPIu}$ from 40% to about 6.7%. From equation (7), input substitution also reduces the

\(^{46}\) Equation (7) could yield a negative value because it is an approximation. If so, $v_{GUPPIr}$ likely would be negligible and should be set equal to zero.
fraction \( S_{UR}^{post} / S_{UR} \) from 1 to 0.917 (since \( v_{GUPPIu} \times PTR_{ur} \times E_{sr} = 0.067 \times 0.5 \times 2.5 = 0.083 \)). It then follows from equation (6) that input substitution reduces \( v_{GUPPIr} \) from 10% to about 1.5% (i.e., 0.067 \( \times 0.5 \times 0.5 \times 0.917 \)).

C. \( v_{GUPPld3} \)

If EDM is merger-specific and cognizable and the downstream merging firm also has some ability to substitute inputs from rival suppliers with inputs from the upstream merger partner, then the \( v_{GUPPld} \) formula is given as follows:

\[
v_{GUPPld3} = v_{GUPPld2} - E_{sd} \times (M_{ud})^2 \times W_D / P_D\]

(8)

where \( v_{GUPPld2} \) is given in equation (4) and \( E_{sd} \) denotes the premerger elasticity of the upstream merging firm’s share of the downstream merging firm’s input purchases with respect to the price that the upstream firm charges to the downstream firm. As equation (8) shows, \( v_{GUPPld3} \) is lower than \( v_{GUPPld2} \). The input substitution further reduces the upward pricing pressure and more likely will result in downward pricing pressure.

**Example 7: \( v_{GUPPld} \) when there is EDM and input substitution**

Consider again Example 3 where, in the absence of EDM and input substitution, \( v_{GUPPld1} \) is equal to 6.25%. Assuming that the upstream merging firm earns a margin of 50% on input sales to the downstream merging firm, i.e., \( M_{ud} = 50\% \), and that the input price per unit of output is half the output price of the downstream merging firm, i.e., \( W_D / P_D = 0.5 \), we found \( v_{GUPPld2} = -18.75\% \). Thus, in this illustrative example, accounting for cognizable EDM was sufficient to turn a positive \( v_{GUPPld1} \) into a negative \( v_{GUPPld2} \). If we also account for input substitution by the downstream merging firm, the EDM effect becomes even stronger. To illustrate, suppose that the downstream merging firm has the same ability as the targeted rival to substitute inputs between the upstream merging firm and other suppliers, i.e., \( E_{sd} = 2.5 \). Then, equation (8) implies \( v_{GUPPld3} = -50\% \) (i.e., \( -18.75 - 2.5 \times 0.5^2 \times 0.5 \)).

D. **DATA REQUIREMENTS AND CALIBRATION**

In order to calculate the \( v_{GUPPI} \)s when there is no input substitution, it is necessary to have information similar to what is needed to calculate standard horizontal GUPPIs. These data include the margins and prices of the upstream merging firm and the downstream firms, as well as the diversion ratios among the downstream firms. In addition, the analyst requires an estimate of the cost pass-through rate of the upstream merging firm.
Certain variables might need to be estimated. To account for potential input substitution between the input of the upstream merging firm and other suppliers of the relevant input, it is necessary to estimate the elasticities $E_{SR}$ and $E_{P}$ for each targeted rival. In addition, it is necessary to estimate the elasticity $E_{SD}$ for the downstream merging firm to account for merger-specific EDM resulting from input substitution. These elasticities might be estimated from data in public or proprietary documents from the merging firms or from natural experiments.

These elasticities also may be inferred from other variables and the assumption of profit-maximization. In particular, if one assumes for simplicity that downstream firms are symmetric, then profit-maximization by the upstream merging firm implies:

$$E_{SR} = E_{SD} = 1 / M_U - E \times E_{P}$$  \hfill (9)

where $E$ denotes the elasticity of downstream market demand with respect to an increase in the downstream market price. If an estimate of the market elasticity $E$ is available, then equation (9) can be used together with an estimate of the input price pass-through elasticity $E_{P}$ to “calibrate” the values of $E_{SR}$ and $E_{SD}$. If instead an estimate of $E$ is not available, one can assume $E = 1$, and if an estimate of $E_{P}$ is not available then one can use the approximation:

$$E_{P} = PTR_{R} \times W_{R} / P_{R}$$  \hfill (10)

where $PTR_{R}$ is the standard cost pass-through rate that applies when a downstream firm incurs an increase in its marginal cost of production (and does not expect any changes in its competitors’ prices).

**Example 8: Calibrating the values of $E_{SR}$ and $E_{SD}$**

Assuming that $PTR_{R} = 0.5$ and $W_{R} / P_{R} = 0.5$, then equation (10) implies that $E_{P} = 0.25$ (i.e., $0.5 \times 0.5$). Assuming a 50% margin and a market elastic-

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48 By definition, $E_{P} = PTR_{R} \times (\Delta C_{e} / \Delta W_{R}) \times W_{R} / P_{R}$. Equation (10) thus might overstate the value of $E_{P}$ because it implicitly assumes that $\Delta C_{e} / \Delta W_{R} = 1$. This assumption is correct when there is no input substitution.

49 When there are multiple targeted downstream rivals, the elasticity $E_{P}$ also could be higher as well as the diversion ratio. See supra Part I.D. This depends on whether each targeted rival expects that the other targeted rivals also will face an input price increase and raise their prices as a result. The simpler approach would hold the beliefs and strategies of all non-merging firms (including the targeted downstream firms) constant and thus the same as their pre-merger beliefs and strategies, which would not lead to a higher $E_{P}$. This is the approach used for horizontal GUPPIs and therefore the most straightforward extension of the GUPPI methodology to vertical mergers.
ity of 1 (i.e., $M_U = 50\%$ and $E = 1$), equation (9) implies $E_{SR} = E_{SD} = 1.75$ (i.e., $1 / 0.5 – 1 \times 0.25$).

III. FURTHER POLICY ANALYSIS

Implementation of the vGUPPI methodology by the agencies would involve several additional policy decisions. First, the agencies would need to decide whether to focus on the $v\text{GUPPI}_u$ or the $v\text{GUPPI}_r$. Second, they would want to decide whether or not to apply a safe harbor, and if so, at what level.

A. $v\text{GUPPI}_u$ VERSUS $v\text{GUPPI}_r$

In horizontal mergers, there is a GUPPI for each product sold by the merging firms. We have calculated three basic vGUPPIs, one for the output price of the downstream merging firm ($v\text{GUPPI}_d$), one for the input price charged by the upstream merging firm to a rival of the downstream merging firm ($v\text{GUPPI}_u$), and one for the output price of the downstream rival targeted for the input price increase ($v\text{GUPPI}_r$). While it is clear that $v\text{GUPPI}_d$ should be used to score the merger impact on the pricing incentives of the downstream merging firm, there could be a policy debate about $v\text{GUPPI}_u$ and $v\text{GUPPI}_r$. Competitive effects analysis (and any safe harbor or anticompetitive presumptions) could be based on the $v\text{GUPPI}_r$ of the targeted downstream rival instead of, or in addition to, the $v\text{GUPPI}_u$ of the upstream firm.

In our view, there is a good policy rationale to prefer the use of the $v\text{GUPPI}_r$ instead of $v\text{GUPPI}_u$. The $v\text{GUPPI}_r$ is more relevant to gauging harm to the consumers that purchase the downstream product. Even if the $v\text{GUPPI}_u$ is large, the input may be sufficiently unimportant that it would not lead to significant effects downstream. However, there are arguments that it would be inappropriate to eliminate a policy role for $v\text{GUPPI}_u$. It might be argued that harm to the downstream targeted rivals is or should be sufficient harm to be cognizable. That is, these targeted downstream rivals also might be “consumers” for the purposes of vertical merger enforcement.

There are competing doctrinal threads here. On the one hand, *Aspen Skiing* makes it clear that it is necessary to show consumer harm, not simply harm to a rival.\textsuperscript{50} Vertical restraints cases like *Jefferson Parish* that allege exclusionary effects from exclusive dealing are treated similarly.\textsuperscript{51} However, on the other hand, the 2010 Guidelines take the approach that it is not necessary to show adverse effects on consumers in downstream markets for mergers of compet-


ing buyers that raise buy-side competitive concerns. It appears that the Agencies intend that harm to the sellers would be sufficient to render the merger anticompetitive. Thus, this remains a policy issue for any revision of the U.S. Non-Horizontal Merger Guidelines.

B. SAFE HARBORS

In light of the numerous policy issues raised in this article, it is premature for us to recommend specific vGUPPI levels for use in a preliminary safe harbor, or indeed whether to implement safe harbors. Instead, we merely will highlight a number of discussion issues that will be relevant in making that determination. First, there is the issue of whether to specify the safe harbor in terms of the \( vGUPPI_r \) or the \( vGUPPI_u \). The \( vGUPPI_u \) better predicts the harm to the downstream competitors who are customers of the upstream merging firm. However, harms to the customers of the downstream competitors are better predicted by the \( vGUPPI_r \).

Second, there is the issue of whether to specify safe harbors based on the simplest vGUPPIs derived for an input price increase that targets a single rival, or whether to take into account the potential or likelihood of multi-rival targeting of post-merger input price increases. The latter clearly predicts a greater incentive to foreclose.

Third, there is the issue of which \( vGUPPI_d \) to specify for the safe harbor. The most restrictive approach would be to use \( vGUPPI_d1 \) where it is not clear whether EDM will be a cognizable efficiency benefit, but use the \( vGUPPI_d2 \) or \( vGUPPI_d3 \) where it likely would be cognizable.

Fourth, there is the issue of whether to reduce the data requirements of an initial screen by relying on assumed values for the pass-through rate \( PTR_u \) and assuming no input substitution, as set out in Part I, supra. For example, one

52 2010 Guidelines, supra note 9, § 12 (“Nor do the Agencies evaluate the competitive effects of mergers between competing buyers strictly, or even primarily on the basis of effects in the downstream markets in which the merging firms sell.”) This analysis seems to assume no merger efficiencies. If there are efficiencies, then there could be a trade-off between harm to the sellers and benefits to consumers. See Steven C. Salop & Serge Moresi, Updating the Merger Guidelines: Comments (Public Comment to Horizontal Merger Guidelines Review Project, Nov. 2009), available at http://www.ftc.gov/os/comments/horizontalermergguide/545095-00032.pdf.

53 The 2010 Guidelines, supra note 9, § 6.1, suggest a horizontal GUPPI safe harbor when “the value of diverted sales is proportionately small.” A subsequent speech by then-deputy AAG Carl Shapiro explicitly specified the safe harbor level as a GUPPI less than 5%. Carl Shapiro, Deputy Assistant Att’y Gen., Antitrust Div., U.S. Dep’t of Justice, Remarks Before the ABA Section of Antitrust Law Fall Forum: Update from the Antitrust Division 24 (Nov. 18, 2004), available at http://www.justice.gov/atr/public/speeches/264295.pdf. (“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%.”) This GUPPI safe harbor presumably is premised on a certain level of presumed efficiency benefits, along with other competitive effects factors and uncertainty.

54 See supra Part I.D.
simple approach would be to assume $\text{PTR}_{\text{U}} = 50\%$ and assume further that there is no input substitution or EDM.\(^{55}\) It might be argued that basing the safe harbor on no EDM or input substitution could lead to an overly intrusive standard. The argument on the other side is that a safe harbor is intended to be narrow. Moreover, the actual value of $\text{PTR}_{\text{U}}$ might be expected sometimes to exceed the default level of 50%. Finally, concerns about over- or under-intrusiveness also can be eliminated by changing the safe harbor level rather than the assumptions on which it is based.

IV. COMPARING vGUPPI\(u\) TO THE VERTICAL ARITHMETIC METHODOLOGY

“Vertical arithmetic” is another methodology that has been used to score foreclosure incentives in vertical mergers.\(^{56}\) The vGUPPIs and vertical arithmetic have similar goals and the calculations share a common approach. In fact, the vertical arithmetic can be expressed as a vGUPPI\(u\) test with a specific safe harbor.

However, there are several differences. First, the vertical arithmetic gauges only the likelihood of withholding the input. Unlike the vGUPPIs, it does not gauge the impact on prices paid by consumers in the downstream market. Second, and related, the vertical arithmetic does not take into account the impact of EDM, whereas the vGUPPI\(d\) does. Third, the vertical arithmetic evaluates the incentive for non-price rationing through a partial or total refusal to deal, whereas the vGUPPIs evaluate pricing incentives.

For mergers in markets where the input price is fixed at a regulated level, the vertical arithmetic can be used to evaluate the incentives for non-price exclusion (i.e., denying, delaying, or degrading access) from a facility that is used as an input by downstream competitors and is controlled by the upstream merging partner. For example, it would apply to telephony mergers where the price of access to the local ILEC network is regulated. However, in markets where input prices are not regulated but are set by the upstream merging firms, the vGUPPI\(u\) has advantages, even aside from EDM or gauging downstream effects. Increasing input prices is generally a more profitable way of

\(^{55}\) The assumption of $\text{PTR}_{\text{U}} = 50\%$ is consistent with linear demand functions in the downstream output market and fixed-proportion demand functions in the upstream input market. With variable proportions, the upstream cost pass-through rate $\text{PTR}_{\text{U}}$ can be smaller than 50\% (e.g., if downstream demand functions are linear).

\(^{56}\) Vertical arithmetic calculations have been carried out for a number of vertical mergers and joint ventures. See supra note 13.
rationing demand than is withholding input sales at a constant price. This greater profitability normally leads to a greater incentive to foreclose.\textsuperscript{57}

The relationship of the incentives for non-price rationing expressed by the vertical arithmetic methodology and the pricing incentives expressed by the\textit{vGUPPI}\textit{u} is straightforward to explain. Suppose the upstream merging firm were to withhold one unit of the input from a targeted rival of the downstream merger partner but maintain the same input price for the remaining units sold. In that case, the upstream firm’s profits would be reduced by its dollar incremental profit margin $M_u W_u$. Faced with this loss of a unit of the input, the targeted downstream rival would attempt to substitute to other possibly less efficient or more costly inputs. Either way, it might also have the incentive to raise its price. As a result, the downstream rival likely would lose some sales to other downstream firms, including the downstream merger partner. In the simplest vertical arithmetic scenario, it is assumed that these other downstream firms do not raise their prices, but simply absorb the sales diverted to them at their original prices.\textsuperscript{58}

Suppose that the input is used in fixed proportions, for example, one unit of input for each unit of output. Suppose that in response to the withholding of one unit of the input by the upstream merging firm, the downstream merging firm obtains a fraction $DR_{UD}$ of a unit of additional sales. Suppose that it earns a dollar profit margin $M_D P_D$ on each of these sales and, therefore, incremental profits of $DR_{UD} M_D P_D$.

The other downstream firms also obtain additional sales (except of course the foreclosed rival). Those firms also may use the input supplied by the upstream merging firm, and they will purchase more of it as their sales expand post-foreclosure. This diversion to the downstream merging firm and the non-targeted rivals in turn allows the upstream merging firm to recapture a fraction $F$ of the withheld unit from sales to other firms, including the downstream merging firm.\textsuperscript{59} Thus, assuming that the upstream merging firm earns the

\textsuperscript{57} However, in the case of non-price foreclosure that must be lumpy (e.g., all or nothing refusals to deal or discrete quality degradation), non-price foreclosure could end up being more severe than price foreclosure.

\textsuperscript{58} The same assumption also applies to \textit{vGUPPI}\textit{u}.

\textsuperscript{59} Assuming fixed proportions (i.e., each downstream firm purchases one unit of the upstream merging firm’s input for each unit of output produced), $F = R_b$, where $R_b$ is the aggregate diversion ratio, that is, the fraction of the sales lost by the targeted rival that are diverted to the downstream merging firm and the other non-targeted rivals in the market, following a unilateral price increase by the targeted rival. If one assumes that the downstream firms have the same aggregate diversion ratio ($R$) to their competitors, then $F = R = 1 - ME$, where $E$ is the downstream market elasticity and $M$ is the average margin of the downstream firms. See Serge Moresi, Diversion Ratios and Market Elasticity: Some Useful Formulas (2011) (unpublished paper), available at http://crai.com/uploadedFiles/RELATING_MATERIALS/Publications/LAE/Antitrust_and_Competition_Economics/Diversion_Ratios_and_Market_Elasticity_Some_Useful_Formulas.pdf.
same dollar margin from all its customers, the net loss in margin of the up-
stream merging firm is equal to \((1 - F)M_u W_R\).

Comparing the profit gains by the downstream merging partner to the profit
losses by the upstream merging partner, the withholding would be profitable
on balance, if and only if:

\[
DR_{up} M_u P_D > (1 - F) M_u W_R
\]  

(11)

This can be rewritten in terms of the \(vGUPPIu\). Using equation (1), with-
holding one unit of input would be profitable if and only if:

\[
vGUPPIu > (1 - F)M_u
\]  

(12)

For example, suppose that \(vGUPPIu = 15\%\) and \((1 - F)M_u = 20\%,\) so that
equation (9) would not be satisfied. In this case, vertical arithmetic would lead
to the conclusion that (non-price) foreclosure is not profitable. In contrast, if
the input price is not regulated, the \(vGUPPIu\) of 15\% would indicate that it is
profitable for the merged firm to raise the input price. This difference in the
profitability conditions flows from the fact that when the input price is raised,
the customer pays a higher price on all the units it continues to purchase.
However, the vertical arithmetic assumes that the merged firm withholds in-
put sales to a downstream rival but does not raise its price on the units that the
downstream rival continues to purchase. Thus, the withholding strategy of the
vertical arithmetic methodology is less profitable than is the price-increasing
strategy of the \(vGUPPIu\).

One can view of the vertical arithmetic as a \(vGUPPIu\) test with an effective
safe harbor level set equal to \((1 - F)M_u\). This means that use of the vertical
arithmetic could lead to a more or less permissible policy, depending on the
\(vGUPPIu\) safe harbor used by the agency. For example, if \(M_u = 50\%\) and
\(F = 60\%,\) then the use of the vertical arithmetic effectively would amount to a
\(vGUPPIu\) safe harbor of 30\%.

V. CONCLUSION

This article has applied the basic GUPPI methodology to encompass pric-
ing incentives in vertical mergers. It has formulated \(vGUPPIs\) for scoring the
merged firm’s incentives to engage in input foreclosure and reduce output. It
also has analyzed several ways to take EDM into account. The \(vGUPPIs\) thus
can be used for the evaluation of vertical mergers in the same way that stan-
dard GUPPIs are used for horizontal mergers.

This analysis of \(vGUPPIs\) is part of a larger project to design a menu of
“incentive scoring” methodologies for various competitive concerns raised in
merger policy. The standard GUPPIs can be used to score the incentives for
unilateral price increases in horizontal mergers. The basic GUPPI methodology can be extended for firms that compete in quantities or capacity instead of price, bidding markets, and markets with congestion issues. It also can be applied to acquisitions of partial ownership interests.

The vGUPPIs here are used to score the incentives for input foreclosure and downstream unilateral price increases in vertical mergers. We (and our co-authors) have also designed an analogous coordination price pressure index (CPPI) methodology to score the incentives and ability for leading firms in a market to engage in parallel accommodating conduct in the context of horizontal mergers.

The use of these incentive scoring methodologies represents a significant advance in the economic evaluation of competitive effects analysis for mergers and joint ventures, in particular in the early phase of an investigation. 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 these combinations. While incentive scoring is not the only information relevant for evaluating likely effects, it clearly is useful evidence.

Incentive scoring methodologies are more informative than simple structural measures such as the HHI or other concentration indices. The increase in the HHI generally does not relate directly to the change in unilateral incentives caused by a merger. As a matter of economic analysis, those concentration indices are particularly relevant for some types of conduct but not others. Thus, economic analysis does not support concentration having the primary predictive role ascribed to it in cases like Philadelphia National Bank. This shortcoming of concentration as a predictor has now been recognized in cases like Baker Hughes. Incentive scoring methodologies like the GUPPI, vGUPPI and CPPI can help fill the gap.

60 Moresi, supra note 12.
61 Id.
Additional incentive scoring methodologies also are needed. The vGUPPi is designed primarily to address input foreclosure concerns in vertical merger cases. A somewhat different analysis likely is needed to evaluate the incentives to engage in customer foreclosure. Similarly, the CPPI is designed to address coordinated price increases through parallel accommodating conduct. A somewhat different analysis likely is needed to evaluate the incentives to engage in collusive conduct that relies on detection and punishment of defections from tacitly agreed-upon terms of coordination.\textsuperscript{68} We hope that this article helps create further momentum to move antitrust analysis forward in this direction.

\textsuperscript{68} Analysis of the incentives to engage in coordination also may differ if firms interact in multiple markets. See, e.g., B. Douglas Bernheim & Michael D. Whinston, \textit{Multimarket Contact and Collusive Behavior}, 21 RAND J. ECON. 1 (1990).
GLOSSARY

Firm U, Firm D, Firm R: The upstream merging firm (U), the downstream merging firm (D) and the downstream rival (R) targeted for input foreclosing price increases.

**Diversion Ratio DR_U:** The fraction of Firm U’s sales lost (when Firm-U raises its price) that are gained by Firm-D.

**Diversion Ratio DR_R:** The fraction of Firm R’s sales lost (when Firm-R raises its price) that are gained by Firm-D.

**Diversion Ratio DR_D:** The fraction of Firm D’s sales lost (when Firm-D raises its price) that are gained by Firm-U.

**Upstream Prices W_R and W_D:** Input prices charged by Firm U to Firm R and Firm D, respectively.

**Upstream Average Price W_U:** Average input price charged by Firm U to all downstream firms, excluding Firm D.

**Downstream Prices P_R and P_D:** Output prices charged by Firm R and Firm D, respectively.

**Average Upstream Margin M_U:** Firm U’s average variable profit margin (i.e., its average price charged to all firms except Firm D less its variable cost, W_U - C_U) expressed as a percentage of its average price. That is, M_U = (W_U - C_U) / W_U.

**Upstream Margin M_UU:** Firm U’s variable profit margin on input sales to Firm-D.

**Downstream Margin M_D:** Firm D’s variable profit margin (i.e., its price less its variable cost, P_D - C_D) expressed as a percentage of its price. That is, M_D = (P_D - C_D) / P_D.

**Downstream Margin M_R:** Firm-R’s variable profit margin (i.e., its price less its variable cost, P_R - C_R) expressed as a percentage of its price. That is, M_R = (P_R - C_R) / P_R.

**Upstream Pass-Through Rate PTR_U:** The absolute (i.e., dollar) increase in the input price charged to Firm R (ΔW_R) following an absolute increase in Firm-U’s marginal cost of serving Firm R (ΔC_U), expressed as a percentage of the increase in marginal cost. That is, PTR_U = ΔW_R / ΔC_U.

**Downstream Pass-Through Rate PTR_R:** The absolute (i.e., dollar) increase in the output price charged by Firm-R (ΔP_R) following an absolute increase in Firm-R’s marginal cost of production (ΔC_R), expressed as a percentage of the increase in marginal cost. That is, PTR_R = ΔP_R / ΔC_R.

**Downstream Pass-Through Elasticity E_R:** The percentage increase in Firm-R’s output price caused by a one-percent increase in Firm-U’s input price charged to Firm-R. That is, E_R = (ΔP_R / P_R) / (ΔW_R / W_R). Equivalently, E_R = PTR_R × (ΔC_R / ΔW_R) × W_R / P_R.

**Market Elasticity E:** The percentage reduction in downstream market demand caused by a one-percent increase in the downstream market price.
Purchase Share $S_{UR}$: Firm-$U$’s share of Firm-$R$’s total purchases of the relevant input.

Purchase Share Ratio $S_{UR}^{post}/S_{UR}$: The ratio of Firm-$U$’s share of Firm-$R$’s input purchases after the target price increase to the share before the input price increase.

Purchase Share Elasticities $E_{SR}$ and $E_{SD}$: $E_{SR}$ is the elasticity of the purchase share $S_{UR}$ with respect to an increase in the input price $W_R$ that Firm-$U$ charges to Firm-$R$. Similarly, $E_{SD}$ is the elasticity of Firm-$U$’s share of the input purchases of Firm-$D$ with respect to an increase in the input price $W_D$ that Firm-$U$ charges to Firm-$D$. 