Price Theory and Merger Guidelines

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I. INTRODUCTION

The innovations of the new U.K. and U.S. merger guidelines released last year have excited many economists. On the one hand, they apply in nearly as broad a range of merger contexts as traditional market definition and HHI-based approaches do. On the other hand, they incorporate the explicit economic grounding in the logic of differentiated products competition enjoyed by merger simulation. Furthermore, the core intuition behind the guidelines, as clearly exposited by Farrell and Shapiro,[2] is simple and transparent. It can be explained as follows:

> If Crest merges with Colgate, Crest must consider that every time it sells a tube of toothpaste there is a partial tube of Colgate that will go unsold as a result of an additional sale of Crest. Thus, post-merger the mark-up that would have been earned on the unsold partial tube is a new opportunity cost of selling Crest. This will encourage Crest to raise its price(s).

This logic indicates that in reviewing a hypothetical merger both the *diversion ratios* between the products (e.g., the fraction of a tube of Colgate lost when an extra tube of Crest is sold) and the firms' mark-ups over marginal cost are important. The product of the diversion ratio and the mark-up is referred to as the "Upward Pricing Pressure" (UPP).

Despite the clear intuition behind UPP, a number of objections have been raised against its use in merger analysis. First, Coate and Simons[3] argued that, unlike market definition, traditional UPP-based approaches rely on the assumptions that firms have constant marginal costs and take other firms' prices as given in a static Nash-in-prices (differentiated Bertrand) equilibrium. Second, Schmalensee,[4] Hausman et al.,[5] and Carlton[6] have argued that the UPP approach can predict only the direction, rather than the magnitude, of price changes, and that even directional predictions require assumptions about "default efficiencies" to avoid flagging every horizontal merger as anticompetitive. Finally, Carlton[7] pointed out that even if quantitative

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[2] Joseph Farrell & Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, 10(1)BERKELEY ELECTRONIC J. THEORETICAL ECON.: POLICIES & PERSPECTIVES 1 (2010), (*hereinafter* Farrell & Shapiro (2010a)).

[3] Malcolm Coate & Joseph Simons, *Critical Loss vs. Diversion Analysis?*, 12(1)CPI ANTITRUST CHRON. (2009).

[4] Richard Schmalensee, *Should New Merger Guidelines Give UPP Market Definition?* 12(1)CPI ANTITRUST CHRON. (2009).

[5] Jerry Hausman, Serge Moresi, & Mark Rainey, *Unilateral Effects with General Linear Demand, available online at* http://econ-www.mit.edu/files/5926 (2010).

[6] Dennis W. Carlton, *Revising the Horizontal Merger Guidelines*, 6(3) J. COMPETITION L. & ECON.,pp. 619-652. (2010).

[7] *Id.*

predictions could be obtained, the aggregation of these predictions into a single welfare number may be difficult, especially when not all effects on consumer welfare come directly from changes in prices. While some of these concerns apply to nearly all alternative approaches, they still offer opportunities for improvement.

Following the ecumenical spirit of the new guidelines (Shapiro),[8] we have recently written an academic paper, *The First-Order Approach to Merger Analysis*, that builds on the UPP "first-order" approach pioneered by Shapiro,[9] Werden,[10] Froeb et al.,[11] and Walters[12] by incorporating into it key advantages of market definition and merger simulation. This allows us to address the critiques discussed above without abandoning the spirit of the first-order approach. In particular, we establish conditions under which the impact of a merger on consumer welfare can be approximated in the form

$$\Delta CS \approx -g^T \cdot \rho \cdot Q . \qquad (1)$$

Here Q is the pre-merger quantity vector, and ρ and g are respectively the *merger pass-through* matrix and the *generalized pricing pressure* (GePP) vector, both of which we discuss below. This approximation is valid when g is not too large, as in most mergers requiring detailed quantitative static price analysis, and ρ is not too curved, a necessary condition for quantitative approximation (say from merger simulation) based on pre-merger data to be valid.

II. GEPP

GePP generalizes UPP—to which it is equivalent in the presence of Bertrand conduct and constant marginal costs—by making two critical changes.

First, in GePP, the diversion ratio is not computed holding fixed the prices of all other goods but rather *holding fixed the price of the merger partner's good* and *allowing all other prices to adjust as the merging firms would expect them to in equilibrium*. Under Bertrand conduct, these other prices do not adjust at all, but under Cournot conduct or some form of conjectural variations firms may expect "accommodating reactions" from their competitors. In this case, the diversion ratio relevant in GePP is likely to be larger than under Bertrand, as we discuss below.

Compared with UPP, the GePP diversion ratio is easier to apply in practice, as it does not require holding fixed other firms' prices. In particular, it may be applied to solution concepts, such as the Bresnahan[13] model of consistent conjectures, under which, unlike under Bertrand

[8] Carl Shapiro, *The 2010 Horizontal Merger Guidelines: From Hedgehog to Fox in Forty Years*, (77)ANTITRUST L.J., pp. 701-760 (2010).

[9] Carl Shapiro, *Mergers with Differentiated Products*, 10(2)ANTITRUST, pp. 23-30 (1996).

[10] Gregory J. Werden, *A Robust Test for Consumer Welfare Enhancing Mergers Among Sellers of Differentiated Products*, 44(4) J. INDUS. ECON., pp. 409-413 (1996).

[11] Luke M. Froeb, Steven Tschantz, & Gregory J. Werden, *Pass-Through Rates and the Price Effects of Mergers, International* 23(9-10) J. INDUS. ORGAN., pp.703-715 (2005).

[12] Chris Walters, *Diversion Ahead! Approximation Diversion Ratios for Retail Chain Mergers* (2007) *available online at* http://www.mmc.gov.uk/our_role/analysis/diversion_ratios.pdf.

[13] Timothy F. Bresnahan, *Duopoly Models with Consistent Conjectures*, 71(5) AMER. ECON. REV., pp. 934-945 (1981).

conduct, the relevant elasticities of demand can be estimated with only instruments for the pricing behavior of the two merging firms (Baker & Bresnahan).[14]

Second, an additional term is added in GePP that does not appear in UPP, as it is zero under Bertrand conduct. For firm *i*, this term is:

$$-p_i\left(\frac{1}{\eta_i}-\frac{1}{\varepsilon_i}\right), \qquad (2)$$

where p_i is firm *i*'s price, η_i is the elasticity of firm *i*'s demand when its merger partner's price adjusts as expected, and ε_i is firm *i*'s demand elasticity holding its merger partner's price fixed.[15] To the extent that other firms are expected to accommodate a price increase (by also raising prices), ε_i will typically exceed η_i (demand is more elastic without accommodation). Thus, UPP is partially offset because the merger raises the effective elasticity of demand by ending accommodating reactions. Estimates of pre-merger accommodating reactions could either be based on data from the industry or information from industry experts, or on internal documents indicating the firms' expectations about rivals' reactions to price changes combined with an assumption that those expectations are correct.

Note that when the effect (2) is strongest the GePP diversion ratio is also likely to be large relative to the Bertrand diversion ratio: Accommodating reactions by competitors raise the diversion ratio by increasing sales absorbed by the merger partner and decreasing those lost by the firm considering a marginal sale. Thus, the offset from the end of the merging partner's accommodating reactions may be partly or even fully counteracted by the (larger) GePP diversion ratio, so that the total value of GePP may not diverge too greatly from that of UPP. In our paper we show a formal example of these offsetting effects in a symmetric industry. Thus the ease of estimating GePP under a solution concept such as consistent conjectures may be valuable even if one believes Bertrand behavior is a good model of industry conduct.

III. MERGER PASS-THROUGH

The pass-through rate refers to the rate at which changes in marginal cost are converted into changes in prices. Intuitively, a pass-through rate factor is needed to convert the opportunity costs associated with pricing pressure into actual price changes.

The merger pass-through rate, the rate at which GePP is converted into price changes, is a mixture of the pre-merger and post-merger pass-through rates. Merger pass-through is likely to be close, under the same conditions that our price change approximation is valid, to pre-merger pass-through as well as, under more specific circumstances, post-merger pass-through. Thus, our

[14] Jonathan B. Baker & Timothy F. Bresnahan, *The Gains from Merger or Collusion in Product-Differentiated Industries*, 33(4) J. INDUS. ECON., pp.427-444(1985) and *Estimating the Residual Demand Curve Facing a Single Firm*, 6(3) INT'L J. INDUS. ORGAN., pp.283-300 (1988).

[15] For simplicity we here consider the case in which, pre-merger, the firms each produce a single product. When the firms have many products pre-merger, our formulae generalize naturally, but are slightly more cumbersome to express.

work reconciles some of the disagreement on whether pre-merger (Farrell and Shapiro[16]) or post-merger (Froeb et al.[17]) pass-through should be used for first-order merger analysis.

We show how merger pass-through can sometimes be identified precisely from pre-merger pass-through rates, which, as we discuss below, can in turn be calibrated using empirical data from similar industries and intuitions from theoretical work.

IV. WEIGHTING BY QUANTITIES

In Equation (1) the predicted price changes $g^T\rho$ are multiplied by quantities Q. By putting more weight on price changes of widely-purchased goods, this aggregates multiple price changes into a single consumer surplus statistic.[18] This statistic provides a compelling normative basis for analysis and may be normalized (as any price index) into unit free terms by dividing by the current aggregate value of trade in the industry P^TQ. Also, by adding additional terms to (1), one could easily incorporate non-price effects, such as changes in quality or network size (in markets with consumption externalities) that are not typically comparable to price changes.[19]

V. IMPLICATIONS FOR MERGER ANALYSIS

Our findings suggest five important considerations for future revisions of merger guidelines.

1. The diversion ratio relevant to pricing pressure is *the fraction of sales diverted from product B to A when the price of A rises by a small amount, the price of B stays fixed, and all other prices adjust as the firm anticipates they will*. Using this diversion ratio does not require excessive mathematical formalism and may be empirically simpler than using the Bertrand diversion ratio.
2. As Farrell and Shapiro[20] suggest, future guidelines may consider that pre-existing accommodating reactions partially offset UPP.
3. Since multiple price changes can be aggregated into a single consumer surplus statistic, the analytic approach in the guidelines may be explicitly extended to the case of multi-product firms.
4. Pass-through, which is not explicitly discussed in the current guidelines, plays an important role in predicting price changes as emphasized also by Farrell and Shapiro.[21] While measuring pass-through precisely can be quite complicated, calibrating intuitions

[16] *Supra* Farrell & Shapiro (2010a) note 2, and Joseph Farrell & Carl Shapiro, *Recapture, Pass-Through and Market Definition*, 76(3) ANTITRUST L.J., pp. 585-604 (2010), (*hereinafter* Farrell & Shapiro (2010b)).

[17] *Supra* note 11.

[18] Our approach may also be used to compute an approximation to the *social* surplus effects if mark-ups are known.

[19] We further discuss welfare effects not directly mediated by prices in Implication 1.5 and *infra* note 22.

[20] *Supra* Farrell & Shapiro (2010a) note 2.

[21] *Supra* Farrell & Shapiro (2010b) note 16.

about its general range may be feasible.[22] Further empirical work on the measurement of pass-through rates would be valuable.

5. Measuring the short-term unilateral price effects of a merger in terms of consumer surplus allows price-effect analysis to be integrated with the analysis of other potential effects of the merger, such as coordinated effects, changes in product characteristics, efficiencies, network effects, or entry.[23]

CONCLUSION

Our work extends existing first-order approaches to merger analysis to provide quantitative estimates of price and consumer surplus changes. We hope that future work further develops this important intersection between merger policy and price theory; such work could benefit both policy and research.

[22] E. Glen Weyl & Michal Fabinger, *Pass-Through as an Economic Tool*, http://www.people.fas.harvard.edu/~weyl/research.htm (2009) and E. Glen Weyl, *Oligopoly Pass-Through*, forthcoming, show that intuitions about the division of surplus between consumers and producers, strategic effects, the effects of demand shocks, and the elasticities of supply and marginal costs can all guide judgments about pass-through in different markets. The elasticity of supply is particularly important, especially in markets that are very competitive (i.e. where residual demand elasticities are large). *Email* E. Glen Weyl at weyl@fas.harvard.edu for further notes.

[23] Two examples suffice to illustrate how non-price effects can be integrated. First, coordinated effects can be incorporated as predicted changes in conduct. Second, as Alexander White & E. Glen Weyl, *Imperfect Platform Competition: A General Framework*, http://white.alex.free.fr/Home/Research.html (2010) have shown, our formula may easily be extended to incorporate network effects of multi-sided platform mergers, by modeling how network effects are valued differently by marginal and infra-marginal consumers (in the spirit of A. Michael Spence, *Monopoly, Quality and Regulation*, 6(2) BELL J. ECON., pp. 417-429 (1975)).