RECAPTURE, PASS-THROUGH, AND MARKET DEFINITION

JOSEPH FARRELL
CARL SHAPIRO*

Delineation of product and geographic markets is often central in antitrust analysis of horizontal mergers.[1] In many cases, the government considers a relevant market in which the merging firms have very substantial shares, but the merging firms claim that the government's proposed market is not a relevant antitrust market and that in the proper relevant antitrust market, which is broader, their shares are much lower.

For example, in *Whole Foods*, the FTC asserted a market for "premium natural and organic supermarkets," in which (as the court noted) the merger would be very highly concentrating; but the firms argued that the relevant market should include all "supermarkets."[2] Similarly, in *Staples*, the FTC asserted a market for "the sale of consumable office supplies through office superstores," in which the merger would have reduced the number of competitors in some metropolitan areas from

* Joseph Farrell is Director, Bureau of Economics, Federal Trade Commission, on leave from his position as Professor of Economics, University of California at Berkeley. Carl Shapiro is Deputy Assistant Attorney General for Economics in the Antitrust Division of the U.S. Department of Justice, on leave from his position as Transamerica Professor of Business Strategy, Haas School of Business, University of California at Berkeley. We began work on this article prior to taking our current government positions. The views expressed here are ours alone and do not necessarily reflect the official views of our respective agencies. We thank Jonathan Baker, Dennis Carlton, Ken Heyer, Serge Moresi, Russ Pittman, Phil Weiser, Greg Werden, and seminar participants at the U.C. Berkeley/Stanford IO Fest and at the Antitrust Division of the U.S. Department of Justice for helpful comments on an earlier draft. We especially thank Steve Salop for encouraging us to develop these ideas, and Glen Weyl for unusually valuable comments.

[1] *See, e.g.*, FTC v. CCC Holdings Inc., 605 F. Supp. 2d 26, 37, 39–40 (D.D.C. 2009) ("Courts generally begin their analysis of a Section 7 case by defining the relevant market." *Id.* at 37) (citations omitted); *but cf.* FTC v. Whole Foods Mkt., Inc., 548 F.3d 1028, 1036 (D.C. Cir. 2008) (noting that "this analytical structure does not exhaust the possible ways to prove a § 7 violation. . . .").

[2] FTC v. Whole Foods Mkt., Inc., 502 F. Supp. 2d 1, 8 (D.D.C. 2007).

two to one and in other areas from three to two; the firms argued for an "overall sale of office products" market.[3]

Typically, both the government and the merging parties claim to be defining the relevant market according to the 1992 Horizontal Merger Guidelines issued by the U.S. Department of Justice and the Federal Trade Commission.[4] Under those 1992 Guidelines, a key question is whether or not a profit-maximizing hypothetical monopolist (HM) controlling a group of products—a candidate market—would increase at least some prices by at least a "small but significant" amount (SSNIP).[5] Data limitations often make it difficult to answer this question reliably by directly estimating the elasticity of demand facing the HM. Other methods are needed.

In previous writings, we and others have explained how to exploit the information contained in pre-merger prices and costs to implement the HM test without directly estimating the elasticity of demand facing the HM.[6] Central to this approach is the observation that pre-merger prices already reflect pre-merger firms' pricing incentives, given whatever market power they enjoy. This approach need not involve or assume static profit maximization. Thus, a natural approach to the HM test is to gauge the *difference* between the pricing incentives facing pre-merger firms and the pricing incentives facing the HM.

Some have suggested that a competent economic analysis must successfully explain pre-merger observations before daring to predict the results of a merger. We disagree. In our experience, consistent with economic logic, one can often more reliably and more readily assess how a merger *changes* pricing incentives, than one could fully assess the underlying forces that determine either pre-merger or post-merger prices. While we have explained the economic logic in detail elsewhere, and do so again from a somewhat different viewpoint below, a simple metaphor may be helpful. If I take a swig from a glass of water, an observer can readily testify that there is less water in the glass than there was; and this testimony is more, not less, reliable because the observer is not basing it on any quantitative assessment of how much water the glass held pre-

---

[3] FTC v. Staples, Inc. 970 F. Supp. 1066, 1073 (D.D.C. 1997).

[4] U.S. Dep't of Justice & Fed. Trade Comm'n, Horizontal Merger Guidelines (1992, rev. 1997) [hereinafter 1992 Guidelines], *available at* http://www.ftc.gov/bc/docs/horizmer.htm.

[5] *Id.* § 1.1.

[6] *See* Joseph Farrell & Carl Shapiro, *Improving Critical Loss Analysis*, ANTITRUST SOURCE, Feb. 2008, http://www.abanet.org/antitrust/at-source/08/02/Feb08-Farrell-Shapiro.pdf (and references therein). Strictly, reference to a single elasticity facing the HM assumes symmetry, as discussed below.

swig, or of how much it now holds post-swig. Returning to merger analysis, Section 7 of the Clayton Act explicitly addresses the *change* in competition, prohibiting mergers that may substantially *lessen* competition.[7] Focusing on the change due to a merger, not on the level, also facilitates use of the correct benchmark: the prices that would prevail but-for the merger. These prices may be uncertain, controversial, or hard to predict, hindering an approach based on price *levels* but not necessarily creating problems for a difference-based approach.[8]

How does this logic apply here—how do the HM's pricing incentives differ from those facing the merging firms and their rivals? Consider the pricing of Product 1, a product in the candidate market that (pre-merger) is sold by Firm A. The HM has different pricing incentives than Firm A has because the HM controls more of the substitutes to Product 1 than does Firm A.[9] We refer to these additional substitutes owned by the HM as *added insider products*. Consumer substitution between Product 1 and these added insider products affects the HM's profits differently than it affects Firm A's.

This difference in pricing incentives is usually understood from the *demand side*. If Product 1's price rises, some of its lost sales are diverted to added insider products (other lost sales typically go to other substitutes not in the candidate market). If the added insider products are as profitable at the margin as Product 1, the HM fully recaptures the profits lost on sales diverted to them, making the HM's effective demand elasticity lower than that faced by Firm A.

Pre-merger, Firm A evidently wished neither to raise nor to lower Product 1's price. The HM's incentive to change that price thus turns on the difference between its incentives and Firm A's. One can assess this difference in incentives by estimating the fraction of the sales lost by Product 1 that are captured by the added insider products. We call this fraction the *group recapture ratio*.[10] Previously, we and others showed how

---

[7] 15 U.S.C. § 18.

[8] If firms have been successfully coordinating pre-merger, but such coordination might well break down, the 1992 Guidelines recognize that the but-for price may be below the prevailing price. But a reader might gain the impression that it is necessary to quantify the but-for price, which is not always the case if one can gauge the difference in incentives.

[9] When a pre-merger firm controls important substitutes or complements that are excluded from the candidate market, HM market definition risks anomalies. In some cases, these anomalies can be avoided by examining the incentives of a hypothetical cartel comprised of the firms selling the products in the candidate market.

[10] In previous work, we used the term "aggregate diversion ratio" for this same concept. *See, e.g.*, Farrell & Shapiro, *Improving Critical Loss Analysis*, *supra* note 6, at 5. The group recapture ratio is the sum of the diversion ratios to all of the products in the group.

to use the group recapture ratio to implement the HM test.[11] We argued that this difference-based approach should be considered alongside other methods of performing the HM test. We also showed how the group recapture ratio, along with margins, can yield a consistency check on methods that estimate the demand elasticity faced by the HM without using the difference information.

In this article we introduce a new difference-based method of testing whether a group of products satisfies the HM test.[12] This method reinterprets the difference in pricing incentives between the HM and premerger firms from the *cost side*. We discuss this interpretation in terms of incentives to cut price rather than incentives to raise price; the substantive conclusions are unaffected. Prior to the merger, when Firm A cuts Product 1's price and sells additional units, some of these sales displace (or cannibalize) profitable sales of substitute products, reducing the profits of those products' owners. Economists call this a "pecuniary negative externality."[13] When these substitutes are added insider substitutes, the HM accounts for, or "internalizes," this negative externality.

To illustrate, consider a merger between Firms A and B, which sell the only two high-end printers, Printers 1 and 2 respectively. If high-end printers are a relevant market, this is a merger to monopoly; but the merging firms argue that high-end printers are too narrow a range of products and will fail the HM test, so that mid-range printers should be included in the relevant market. Doing so lowers the measured shares of Printers 1 and 2, and would thus make some less worried about the merger, although it obviously does not change the merger's true effect.

---

[11] *See id.* (building on Michael L. Katz & Carl Shapiro, *Critical Loss: Let's Tell the Whole Story*, ANTITRUST, Spring 2003, at 49; Daniel O'Brien & Abraham Wickelgren, *A Critical Analysis of Critical Loss Analysis*, 71 ANTITRUST L.J. 161 (2003)). For skeptical views of this approach, see David Scheffman & Joseph Simons, *The State of Critical Loss Analysis: Let's Make Sure We Understand the Whole Story*, ANTITRUST SOURCE, Nov. 2003, http://www.abanet.org/antitrust/at-source/03/11/scheffman.pdf.

[12] Here, as in our earlier article, we apply the 1992 Guidelines; like the literature on critical loss analysis, we focus on the HM test, not on whether the candidate market has been built up of next-best substitutes or on whether a narrower candidate market would also pass the HM test. Farrell & Shapiro, *Improving Critical Loss Analysis*, *supra* note 6. In other work, we have suggested approaches that would depart from those 1992 Guidelines. In particular, in a recent article, we use the opportunity-cost framework in a different way. Joseph Farrell & Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, B.E. J. THEORETICAL ECON.: POLICIES & PERSPECTIVES, Vol. 10, No. 1, Art. 9 (2010), http://www.bepress.com/bejte/vol10/iss1/art9. [hereinafter *An Economic Alternative to Market Definition*].

[13] The word "pecuniary" signals to economists that this is not necessarily a problem that it would be socially desirable to repair.

Suppose that before the merger Printers 1 and 2 each sell for $100,000, and each printer sold generates a profit margin, or contribution towards fixed costs, of $40,000. This is one of the three key pieces of data required by our method. For the second key piece of data, suppose the diversion ratio between the two high-end printers is 25 percent, meaning that 25 percent of the sales captured by cutting the price of one printer come at the expense of the other printer. For a candidate market such as this one that contains only two products, the diversion ratio is the same as the group recapture ratio.[14]

In pricing Printer 1, how do the incentives of a HM controlling both printers differ from those of Firm A? Since the diversion ratio is 25 percent, for every four extra units sold of Printer 1 when its price falls, the HM sells one fewer unit of Printer 2, which had generated a profit margin of $40,000. Dividing this by the four extra units of Printer 1, the HM loses $10,000 of profits on Printer 2 for each extra unit sold of Printer 1.[15] This $10,000 amounts to a marginal cost of Printer 1 that the HM faces but that Firm A did not. This opportunity cost affects pricing incentives for Printer 1, just as would any other marginal cost.

Higher marginal costs generally lead to higher prices. But how much higher? Suppose Firm A passes through higher marginal costs for Printer 1 to higher prices at a 60 percent rate. This is the third key piece of data for our method. Then the $10,000 extra marginal cost will lead to a price increase for Printer 1 of $6000, which equals 6 percent of the prevailing price of Printer 1. But this answers precisely the question posed by the HM test: would the HM raise price by at least a SSNIP, usually taken to be 5 percent of the prevailing price?[16]

Our basic test thus involves three steps. First, calculate the extra marginal "cannibalization" or opportunity cost recognized by the hypothetical monopolist, in this example $10,000 per unit of Printer 1. This typically requires an estimate of pre-merger margins and the group recapture ratio. This opportunity cost is most usefully measured as a frac-

---

[14] As explained below, in a candidate market with more than two firms, the group recapture ratio for one product is the sum of the diversion ratios between that product and each of the other products in the candidate market.

[15] A core result in economic analysis, the "envelope theorem," shows that if Printer 2's price maximizes its profits this is the correct measure of the change in profits on Printer 2, even if there would be profit-maximizing adjustments to the price of Printer 2. If for any reason Printer 2's price does not change with the SSNIP on Printer 1, the same result follows.

[16] This example focuses on whether the HM will raise the price of one product, Printer 1. Below, we first consider a symmetric situation and ask whether the HM will raise the price of all products in the candidate market. We then consider an asymmetric situation and ask whether the HM will raise the price of one specific product, as here.

tion of the prevailing price of Printer 1: in our example, the $10,000 extra marginal cost is 10 percent of that $100,000 price. Second, estimate the rate at which cost increases for Product 1 are passed-through into price increases for that product: in our example, this was 60 percent. Third, multiply these two numbers together: in our example, 10 percent times 60 percent yields 6 percent. Since this 6 percent exceeds the SSNIP size of 5 percent, Printers 1 and 2 together satisfy the HM test.

Below, we develop more general ways to exploit this opportunity cost approach to carry out the HM test. This approach, used alongside or instead of existing methods, may sometimes enable greater accuracy in market definition. In other cases, where key required data cannot be reliably estimated, our method may be less practical as a means of performing the HM test on a candidate group of products, but may still imply some useful checks that may help scrutinize proposed HM markets derived using other methods or types of evidence.

Our method also yields a new consistency check between claims of market definition and claims about the extent to which merger-specific efficiencies will benefit customers. In our example, suppose that we can rely on the estimates of Printers A and B's prices and contribution margins and of the diversion ratio between them, yet the merging parties assert that a market for high-end printers fails the HM test. Using our methods, for this claim to be valid, the rate at which Firm A passes through changes in the marginal cost of Printer 1 would have to be less than 50 percent. If the parties also assert that merger-specific efficiencies will be passed-through to customers purchasing Printer 1 at a rate greater than 50 percent, their market definition and efficiency claims are at least in tension and may well be inconsistent.

I. THE OPPORTUNITY COST APPROACH TO THE HYPOTHETICAL MONOPOLIST

Consider a merger involving Firm A, which owns Product 1, and ask whether Products $1, \ldots, N$ satisfy the HM test. For simplicity, we assume that, prior to the merger, each firm controls just one of these products, and no other products, and sets its price independently to maximize its own profits.

A. NUMERICAL EXAMPLE

Suppose that each product's pre-merger price is $P = \$100$ and its marginal cost is $C = \$60$, so that its absolute gross margin is thus $P - C = \$40$ and its relative gross margin is $M \equiv (P - C)/P = 40\%$.

The *group recapture ratio, REC,* is the fraction of the sales lost by Product 1 when a SSNIP is imposed on its price alone that are recaptured by the added insider products. Suppose that *REC*=50%, meaning that half of the sales lost by Product 1 are recaptured by Products 2,...,*N*. If a price cut on Product 1 increases sales of Product 1 by 100 units, 50 of those units would come at the expense of the added insider products, lowering profits on those products in total by $40 times 50, or $2000. Therefore, when Firm A sells 100 extra units of Product 1 it imposes a $2000 negative pecuniary externality on the owners of Products 2,...,*N*, or a $20 impact per unit of Product 1. This $20 is the multiplicative product of the profit margin, $40, and the group recapture rate of 50 percent.

To the HM, this $20 is an *opportunity cost* of selling an extra unit of Product 1: it reflects a lost opportunity to earn profits from Products 2,...,*N*. As introductory economics classes emphasize, opportunity costs affect economic incentives to sell additional units in just the same way as do out-of-pocket expenses, although they typically receive a different accounting treatment. It may aid intuition to think of the HM wishing to run Product 1 as a profit center. To ensure that Product 1 is not oversold to the detriment of the HM's overall profits, it would have to impose an internal "tax" on each unit of Product 1 sold, equal to the per-unit opportunity cost, calculated here at $20. With that tax in place, the HM could allow Product 1's manager to maximize Product 1's profits—just as Product 1's owner, Firm A, did prior to the merger.

Thus, intuitively, bringing control of Products 1 to *N* under the HM has the same impact on pricing as leaving them under separate control but taxing each product on a per-unit basis, with the per-unit tax on each product being set equal to the negative pecuniary externality imposed on added insider products by a price cut sufficient to expand that product's sales by one unit.[17] That negative pecuniary externality is in principle calculated at the prices and outputs chosen by the HM. As a method to actually calculate what the HM would do, therefore, this observation appears to risk circularity. It nevertheless is valuable to the extent that we can gauge or bound the pecuniary externality based on premerger observables.

---

[17] This general idea is not new in the economics literature. *See* Theodore Groves & Martin Loeb, *Incentives in a Divisionalized Firm*, 25 MGMT. SCI. 221 (1979). Elsewhere we explain this more formally, for the special case in which two products are in the candidate market, in Proposition 2. Farrell & Shapiro, *An Economic Alternative to Market Definition*, *supra* note 12.

The 1992 Guidelines ask whether the HM will raise the price of Product 1 by at least a SSNIP.[18] Since Product 1's pre-merger price is $100, a 5 percent SSNIP corresponds to a price increase of $5. A $20 increase in marginal cost will lead to at least a $5 increase in price if the rate at which cost increases are passed through into price increases is at least $5/$20 = 25%.

B. Basic Hypothetical Monopolist Test

We now describe this logic more generally, beginning here with the symmetric case—the case usually addressed by critical loss analysis—in which all N products have the same price, P, the same marginal cost, C, and thus the same relative margin, $M=(P-C)/P$. We relax the assumption of symmetry in Part IV below. Denote the size of the SSNIP by S; for instance, $S=0.05$ (five percent) or $S=0.10$ (ten percent).

The group recapture ratio, REC_N, is the fraction of sales lost by Product 1, when its price alone rises a small amount, that are captured by the added insider products, Products $2,...,N$. This ratio is equal to the sum of the diversion ratios from Product 1 to each of the added insider products. We define the group pass-through rate, PTR_N, as the rate at which changes in the pre-merger marginal cost borne by all N firms (but not others) are passed through to prices. Assuming that the firms compete independently on price prior to the merger,[19] the Appendix provides conditions under which we can show:

Proposition 1: In the symmetric case, if $PTR_N \times REC_N \times M > S$ then Products $1,....,N$ satisfy the hypothetical monopolist test.

Proposition 2: In the symmetric case, if $PTR_N \times REC_N \times (M+S) < S$, then Products $1,....,N$ do *not* satisfy the hypothetical monopolist test.

Recall that under the 1992 Guidelines, if a candidate market fails the hypothetical monopolist test, more substitute products are added, until the test is passed.[20] Adding more substitutes to the group increases the group recapture rate REC_N and (in the normal case of differentiated-product pricing) also increases the group pass-through rate PTR_N. So one can think, following the 1992 Guidelines, of repeatedly adding substitutes, thus increasing $PTR_N \times REC_N$; as long as this quantity is below

---

[18] 1992 Guidelines, *supra* note 4, § 1.1.

[19] In Part VI we explain how Propositions 1 and 2 can be generalized to handle situations in which the firms engage in some form of coordination prior to the merger.

[20] 1992 Guidelines, *supra* note 4, § 1.1. As with the symmetric version of critical loss analysis, as different products are added to the candidate market, the assumption of symmetry may become increasingly problematic. We treat the asymmetric case below.

$S/(M+S)$, Proposition 2 tells us that we do not yet have a HM market, while as soon as it exceeds S/M, Proposition 1 tells us that we have a HM market.

These Propositions leave a gray zone: when $PTR_N \times REC_N$ lies between $S/(M+S)$ and S/M, they do not tell us whether or not the HM test has yet been satisfied. However, when S is fairly small relative to the proportional gross margin M, this gray zone is relatively small. For instance, with a 5 percent SSNIP and gross margins of 30 percent, $S/(M+S)$ is one seventh, or about 0.14, and S/M is one sixth, or about 0.16.

Our logic can aid in market definition in two ways. First, it can provide a constructive method of market definition, if two key variables can be estimated: (1) the value of the recaptured business, $REC_N \times M$, which measures the pecuniary negative externality that is internalized by the HM, and (2) the rate at which group-wide changes in marginal cost are passed-through in prices, PTR_N. Below, we discuss measurement of these terms. Second, as a reality check on proposed markets, it can be used to ask how large or small the recapture rate and the group pass-through rate must be for a proposed market to satisfy, or to fail, the HM test. Even in cases where these quantities cannot be formally empirically estimated, there may be other evidence regarding their magnitude.

II. THE VALUE OF RECAPTURED BUSINESS

Our method requires one to estimate the value of the business recaptured by other products in the candidate market when a SSNIP is imposed on one product. While this measurement need not be easy, it is not obviously harder than measuring the value of business lost to products outside the candidate market, as in critical loss analysis. Typically, one might estimate the value of recaptured business by estimating gross margins and the group recapture ratio.

A. MEASURING GROSS MARGINS

Gross margins are regularly estimated in antitrust analysis; for instance, to perform critical loss analysis. In our experience, the antitrust agencies often can reliably estimate gross margins based on materials received from the merging parties.[21] Proposition 1 does not require that margins bear the relationship to demand elasticities that profit maximization implies (the Lerner equation), but the analyst can use that relationship to estimate margins in suitable cases.

---

[21] The relevant cost concept is average incremental cost taken over the number of units gained by each substitute product when a SSNIP is imposed on Product 1.

B. Measuring the Group Recapture Ratio

The group recapture ratio depends upon customer substitution patterns in response to an increase in the price of one product, and may not be easy to measure. However, the hypothetical monopolist test requires some analysis of customers' responses to price changes,[22] and this need not be an especially difficult variant. The group recapture ratio and its close cousin the diversion ratio are also often estimated in competitive effects analysis. For example, basing an estimate of unilateral competitive effect on market shares modified to reflect relative closeness of the merging products, in essence involves gauging diversion ratios. UK competition authorities in particular have embraced explicit measurement and use of diversion ratios.[23] Pre-merger evidence may show how sales have shifted between Product 1 and other products, when the price of Product 1 changed and other prices did not. Planning documents associated with Product 1, win/loss reports, and evidence regarding customer switching patterns can also aid in estimating the group recapture ratio.

III. THE GROUP PASS-THROUGH RATE

A. Measuring the Group Pass-Through Rate

Our method also requires one to gauge the group pass-through rate—the rate at which increases in costs (of a magnitude comparable to the opportunity cost term reflecting cannibalization), applying to all products in the candidate market, are passed through to prices.

Group pass-through rates have not been a standard input in the market definition exercise. Both the difficulty and the feasibility of estimat-

---

[22] For example, critical loss analysis requires one to predict how many sales the HM would lose if it were to raise price by a SSNIP.

[23] *See* Competition Comm'n & Office of Fair Trading, Merger Assessment Guidelines 36 (2009), *available at* http://www.competition-commission.org.uk/about_us/our_organisation/workstreams/analysis/pdf/mergers_guidelines.pdf (UK competition authorities' joint consultation document for the review process for merger guidelines). UK authorities also regularly calculate "illustrative price rises" associated with horizontal mergers. *See, e.g.*, Somerfield PLC and Competition Comm'n, [2006] CAT 4 at ¶¶ 44–45 (UK Competition Appeal Tribunal), *available at* http://www.catribunal.org.uk/files/Jdg1051Somer13022006.pdf. In the United States, the 1992 Guidelines discuss diversion ratios (somewhat elliptically and not by that name) in Section 2.211. *See* Carl Shapiro, *Mergers with Differentiated Products*, ANTITRUST, Spring 1996, at 23; Carl Shapiro, Mergers with Differentiated Products, Address Before the American Bar Association and International Bar Association (Nov. 9, 1995), *available at* http://www.justice.gov/atr/public/speeches/227167.pdf; *see also* Gregory J. Werden & Luke M. Froeb, *Unilateral Competitive Effects of Horizontal Mergers*, *in* HANDBOOK OF ANTITRUST ECONOMICS 43 (Paolo Buccirossi ed., 2007) (providing citations to much of the subsequent literature).

ing them are perhaps illustrated in indirect-purchaser litigation. The group pass-through rate may be difficult to estimate accurately, as the Supreme Court noted in *Illinois Brick*.[24] However, most states have decided that the difficulties are not disabling.[25]

Relevant economic theory and empirical work have advanced considerably in the thirty years since *Illinois Brick*, and economists have published hundreds of articles on pass-through, both in antitrust applications and more broadly.[26] Most empirical studies have been in the contexts of taxation and of exchange-rate movements.[27] Exchange-rate movements in particular provide a "natural experiment" in which the marginal costs of certain imports, but not domestically produced substitutes, exogenously shift. Not surprisingly, pass-through rates vary significantly across industries, as well as with the portion of the industry for which costs change.[28] However, the reported elasticities of price with respect to marginal cost shifts that apply to substantial but not dominant sets of products, such as "German cars sold in the United States," are often on the order of 50 percent or more, especially in the longer run.[29] These elasticities are $1-M$ times the pass-through rate, so with a margin of one-third, an elasticity of 50 percent corresponds to a pass-through

---

[24] Illinois Brick Co. v. Illinois, 431 U.S. 720, 741–42 (1977). Froeb et al. found that pass-through rates are difficult to measure based on econometric estimates of demand. Luke M. Froeb, Steven Tschantz & Gregory J. Werden, *Pass-Through Rates and the Price Effects of Mergers*, 23 INT'L J. INDUS. ORG. 703 (2005). *See also* Farrell & Shapiro, *An Economic Alternative to Market Definition*, *supra* note 12.

[25] For a collection of state statutes permitting indirect purchaser suits, see Edward D. Cavanagh, Illinois Brick*: A Look Back and a Look Ahead*, 17 LOY. CONSUMER L. REV. 1, 2 n.4 (2004).

[26] *See, e.g.*, E. Glen Weyl & Michal Fabinger, Pass-Through as an Economic Tool (Oct. 29, 2009), *available at* http://ssrn.com/abstract=1324426.

[27] *See, e.g.*, Johan Stennek & Frank Verboven, *Merger Control and Enterprise Competitiveness: Empirical Analysis and Policy Recommendations*, *in* EUROPEAN MERGER CONTROL: DO WE NEED AN EFFICIENCY DEFENCE? 202, 264–81 (Fabienne Ilzkovitz & Roderick Meiklejohn eds., 2006) (prepared for the European Commission) (providing a survey).

[28] *See* Rudiger Dornbusch, *Exchange Rates and Prices*, 77 AM. ECON. REV. 93 (1987).

[29] In this large literature, see, e.g., Pinelopi Koujianou Goldberg & Michael M. Knetter, *Goods Prices and Exchange Rates: What Have We Learned?*, 35 J. ECON. LIT. 1243 (1997); Anne Gron & Deborah L. Swenson, *Cost Pass-Through in the U.S. Automobile Market*, REV. ECON. STAT. 316 (2000). These natural experiments with group pass-through usually involve groups of firms defined by some common feature on the supply side, such as location. In contrast, the HM test asks about group pass-through where the group is defined by proximity on the demand side. One might expect higher pass-through rates for groups of products defined by proximity on the demand-side, ceteris paribus, because price increases for each such product themselves encourage further price increases for the others.

rate of 75 percent.[30] For substantial groups of substitutes, such as might be proposed for antitrust markets, it may well be reasonable as a working default to use a group pass-through rate in the 50 to 100 percent range.

B. The Relationship Between Pass-Through Rates and Competition

Some readers may question whether (say) German cars sold in the United States could really have so high a group pass-through rate. Wouldn't competition from American, Japanese, and other cars constrain any price increase? How can small group pass-through rates be substantial within a fairly competitive industry?

Standard economic models can illuminate this question. In a perfectly competitive market as studied in economics textbooks (price-taking firms selling a homogeneous good), the group pass-through rate depends on the group's share and on the ratio of the supply and demand market elasticities, E_S and E_D. Specifically, with linear supply curves, if the group has a share k of supply (and its cost conditions are representative), the group pass-through rate for small cost changes is $kE_S/(E_S+E_D)$. See the Appendix for a proof. Similarly, in a standard Cournot (quantity-setting) oligopoly, with linear demand the group pass-through rate is equal to $G/(N+1)$, where the group has G (active) member firms and the market has N. Group pass-through rates for portions of fairly competitive industries may well be commensurately lower, but cannot be presumed to be near zero. Thus, moderate to high gross margins and group recapture ratios may well suffice to pass the HM test.

Oligopoly pass-through with differentiated products is considerably more complex.[31] But some insights can be gleaned by examining the slightly artificial question of pass-through rates for a single product, taking all other prices as given. This artificial pass-through rate PTR is given by

$$PTR = \frac{E}{E - 1 + (P/E)(dE/dP)}$$

---

[30] The elasticity of price with respect to cost is $[dP/dC]\times[C/P]$. The pass-through rate dP/dC is equal to this elasticity times P/C. Using the definition of the gross margin M ($M = (P-C)/P$), we can express P/C as $P/C = 1/(1-M)$.

[31] For a recent example of such an analysis, see Weyl & Fabinger, *supra* note 26, at 30–34.

where $E=-(dX/dP)(P/X)$ is the elasticity of demand for the product.[32] Thus the *PTR* depends not only on the elasticity of demand, *E*, but also on how *E* varies along the demand curve. Geometrically, *E* reflects the demand curve's slope, and variations in *E* reflect the demand curve's curvature.[33]

Thus even the artificial pass-through rate is not rigidly linked to market power,[34] contrary to a tempting fallacy. Some mistakenly believe that a firm with substantial market power will have a low (or zero) pass-through rate.[35] Perhaps they are focusing on pass-through of cost reductions and mistakenly ask whether a firm with market power is *forced* to reduce its price following a cost reduction, rather than whether it will *have an incentive* to do so.[36] In fact, a firm with a great deal of market power may have a small or a large pass-through rate, depending upon the curvature of the demand curve facing that firm. And the artificial pass-through rate can be quite high, even for a product that faces close substitutes and thus has a relatively elastic demand. Indeed, with constant elasticity of demand, the artificial pass-through rate is greater than 100 percent; with linear demand, it is one-half.

IV. PRODUCTS DIFFER SIGNIFICANTLY IN PRICES OR COSTS

Our methods can also be used when the products in the candidate market differ significantly in their prices or costs, as is common in markets with differentiated products. We denote Product *i*'s price by P_i, its marginal cost by C_i, its relative margin by $M_i=(P_i-C_i)/P_i$, and the diversion ratio from Product 1 to Product *i* by D_{1i}. The single-product pass-through rate for Product 1 is PTR_1: this is the rate at which marginal cost changes idiosyncratic to Product 1 are passed through to P_1.[37] If firms

---

[32] Jeremy Bulow & Paul Pfleiderer, *A Note on the Effect of Cost Changes on Prices*, 91 J. POL. ECON. 182 (1983).

[33] *See* Weyl & Fabinger, *supra* note 26, at 37–40; Farrell & Shapiro, *An Economic Alternative to Market Definition*, *supra* note 12 (providing additional discussion on this formula and its use in antitrust).

[34] Technically, the firm's market power depends upon the product-specific elasticity of demand, but the artificial pass-through rate depends as well on the rate at which the elasticity of demand varies with price.

[35] Another common but faulty intuition suggests that a monopolist will have a high pass-through rate for cost increases but a low pass-through rate for cost decreases. If this were correct, a cost increase followed by an equal cost decrease, leaving cost unchanged, would cause the profit-maximizing monopoly price to go up.

[36] *See* Froeb et al., *supra* note 24.

[37] This single-product pass-through rate, i.e., the rate at which cost changes idiosyncratic to a single product are passed through in the price of that product, is not the same as the artificial pass-through rate. If prices of rival products respond positively to the price of the product in question, i.e., if the products are "strategic complements" regarding pricing, the single-product pass-through rate is at least as large as the artificial pass-

compete independently on price prior to the merger, the Appendix proves:

Proposition 3: If $PTR_1 \times [D_{12}(P_2 - C_2) + ... + D_{1N}(P_N - C_N)] > SP_1$, then Products $1, ..., N$ satisfy the HM test.

The condition in Proposition 3 is the same as:

$$PTR_1 \times [D_{12} M_2 \frac{P_2}{P_1} + ... + D_{1N} M_N \frac{P_N}{P_1}] > S.$$

In the special case where Products $2, ..., N$ have equal margins, this condition can be written as: $PTR_1 \times REC_1 \times (P_2 - C_2) > SP_1$.

The condition in Proposition 3 is sufficient, but far from necessary, for Products $1, ..., N$ to satisfy the HM test. Proposition 3 effectively ignores the opportunity cost terms on Products $2, ..., N$, which push up the prices of those products and thus the price of Product 1 as well. In the symmetric case, $REC_N = D_{12} + ... + D_{1N}$, $P_1 = P_2 = ... = P_N$, $M_1 = M_2 = ... = M_N$ so the expression in Proposition 3 becomes $PTR_1 \times REC_N \times M > S$. For this symmetric case, another sufficient condition, which is closer to necessary,[38] is given in Proposition 1: $PTR_N \times REC_N \times M > S$. These formulae differ in that Proposition 3 (like the example in the Introduction) uses the single-product pass-through rate, PTR_1, while Proposition 1 uses the group pass-through rate, PTR_N. The latter is normally larger, making Proposition 1's condition easier to satisfy: cost increases that apply to a whole group of substitutes normally cause larger price increases than do cost increases that apply only to one product.[39] Academic researchers only rarely have the firm-specific cost information necessary to estimate single-product pass-through rates,[40] but such information may well be available to the Agency during merger review.

---

through rate because it accounts for the accommodating pricing responses of rivals. More formally, if the marginal cost of Product 1 rises, and assuming this is observed by rivals, the new equilibrium involves higher prices for all of the products, not just Product 1. The single-product pass-through rate measures the impact of an increase in the marginal cost of Product 1 on the equilibrium price of Product 1, and this equilibrium response includes the higher prices set by the other firms when the marginal cost of Product 1 rises.

[38] As discussed above, Proposition 2's necessary condition is close to Proposition 1's sufficient condition if margins are substantially larger than the SSNIP considered.

[39] This statement applies under our standing assumption that the profit-maximizing price for any one product is increasing in the price charged by any other product, i.e., that products are "strategic complements."

[40] *See, e.g.*, David Besanko, David Dranove & Mark Shanley, *Exploiting a Cost Advantage and Coping with a Cost Disadvantage*, 47 MGMT. SCI. 221 (2001); David Besanko, Jean-Pierre Dubé & Sachin Gupta, *Own-Brand and Cross-Brand Retail Pass-Through*, 24 MGMT. SCI. 123 (2005).

V. PASS-THROUGH AND MERGER EFFICIENCIES: CONSISTENCY CHECK

Even in cases where pass-through rates are difficult to estimate, our methods offer a consistency check on merging parties' claims that any marginal-cost efficiencies they achieve will benefit customers. A claim about how much of a reduction in Product 1's marginal cost will be passed on to customers amounts to an assertion regarding the single-product pass-through rate for Product 1. By using this pass-through rate in Proposition 3, the claim can be tested for consistency with arguments regarding the HM test.[41]

To illustrate, suppose that the merging firms sell two products in a candidate market, and that each of those products sells for about the same price and earns about the same margin, *M*. Proposition 3 tells us that these products satisfy the HM test if $PTR_1 \times REC_1 \times M > S$. If the margins are 25 percent, the SSNIP is 5 percent, and the group recapture ratio for Product 1 is 40 percent, then this condition holds if the single-product pass-through rate for Product 1 is at least 50 percent.

VI. OLIGOPOLISTIC INTERACTIONS

Our tests described above assumed that the firms compete independently on price prior to the merger. Under this assumption, the internalized opportunity cost of gaining more sales for one product is measured by the recapture term as given above. If the firms behave differently prior to the merger, the analysis must be modified.

Glen Weyl has shown how the opportunity cost logic developed here extends to cases in which firms' pre-merger behavior includes anticipated reactions, such as accommodating behavior, rather than the independent price-setting behavior assumed above.[42] His modified measure of the recapture rate accounts for anticipated pricing responses for added insider products but holds fixed the prices of products outside the candidate market.

If a group of firms engage in pre-merger coordination, one might conclude rather directly that their products pass the HM test, since they

---

[41] Froeb et al., observe that "gross merger effects [the price increase absent marginal-cost efficiencies] and pass-through effects [of marginal-cost efficiencies] are closely related. Both are determined largely by the degree of profit (demand) concavity." Froeb et al., *supra* note 24, at 704. *See* Farrell & Shapiro, *An Economic Alternative to Market Definition*, *supra* note 12 (showing how the "gross merger effects" can themselves be viewed as pass-through of an opportunity-cost term).

[42] E. Glen Weyl, Pass-Through and Merger Analysis (2010) (unpublished manuscript, on file with authors).

have found it profitable to coordinate. The 1992 Guidelines allow for this by basing the SSNIP on the lower "competitive price" in situations where pre-merger evidence strongly suggests coordinated behavior.[43] This avoids errors in situations where prices are elevated by pre-merger coordination that might weaken or break down absent the merger.

VII. CONCLUSION

We showed how the 1992 Guidelines question of a hypothetical monopolist's pricing incentives can be viewed in economic terms as the pass-through of opportunity-cost shifts in products' marginal costs. If firms price independently prior to the merger, the opportunity-cost term relates in familiar ways to margins and diversion ratios. We showed how this lets one implement the hypothetical monopolist test using the rate at which costs are passed through into prices. This approach yields simple conditions, expressed in our three Propositions, for a candidate group of products to satisfy the HM test.

Some general principles emerge from the opportunity-cost approach developed here:

- The larger are the pre-merger margins, the narrower a group of products will satisfy the HM test, because higher margins imply higher opportunity costs.
- The more strongly costs are passed through to prices, the narrower a group of products will pass the test.
- The smaller the SSNIP chosen, the narrower a group of products will pass the test.
- Efficiency claims can be tested for consistency with claims about market definition. High pass-through rates mean that customers will gain more from merger-specific efficiencies, but they also imply narrower HM markets.

---

[43] 1992 Guidelines, *supra* note 4, § 1.11.

APPENDIX

A. PROOF OF PROPOSITION 1

PROPOSITION 1: In the symmetric case, if $PTR_N \times REC_N \times M > S$ then Products $1, ..., N$ satisfy the hypothetical monopolist test.

We first prove Proposition 1 under the assumption that PTR_N and REC_N are constant in the neighborhood of the pre-merger costs and prices; we then discuss the technical conditions necessary for the proof to apply without this assumption.

The proof proceeds by showing that a hypothetical monopolist controlling all N products would raise the price of all of these products by at least a fraction S. The HM's profit-maximizing prices are equal to the prices that would result under pre-merger competition if each product is priced by a "division manager" who maximizes only the profits on the single product under its control, if corporate headquarters imposes a per-unit tax on each division equal to the negative pecuniary externality imposed on the other divisions when that division sells one more unit of its product. This equivalence is proven in Proposition 2 in Farrell and Shapiro (2010).[44]

The prices set by the HM can be constructed by setting a per-unit tax on each division based on the pre-merger pecuniary externality, calculating the resulting prices, re-calculating the externality, and adjusting the tax and prices iteratively. If this process converges—which it will under reasonable conditions, and which we assume here—it converges to a profit maximum for the HM.

Denote by T^k the per-unit tax on each product at round k of this iterative procedure. The first-round tax is:

$$T^1 = REC_N \times (P - C),$$

where P is the pre-merger price. Denote by P^1 the price of each product resulting from this tax. Using $PTR_N \times REC_N \times M > S$, we know that $P^1 > P(1+S)$, i.e., each product's price rises by at least a SSNIP as a result of the first-round tax. However, P^1 is not the profit-maximizing price, because T^1 measures the externality at the pre-merger price, not at P^1. The next step in the iterative procedure is to set T^2 equal to the externality at price P^1:

$$T^2 = REC_N \times (P^1 - C).$$

Since $P^1 > P$, with a constant recapture rate we must have $T^2 > T^1$. Denote by P^2 the price of each product resulting from the tax T^2. With a

---

[44] Farrell & Shapiro, *An Economic Alternative to Market Definition*, *supra* note 12.

positive pass-through rate, we know that $P^2 > P^1$. Repeating this procedure, this same argument shows that $T^{k+1} > T^k$ and $P^{k+1} > P^k$ at each stage. So long as this process converges, the limiting values are the tax equal to the externality at the profit-maximizing price, and that price itself. Since taxes and prices go up monotonically, the limiting value of P is larger than P^1, and thus involves a price increase of at least a SSNIP.

We can now somewhat relax the assumption that PTR_N and REC_N are constant in the neighborhood of the pre-merger costs and prices.

Regarding the pass-through rate PTR_N, the first step in the iterative procedure used the pass-through rate relevant to the cost change $REC_N \times (P - C)$. For the purposes of this proof, to handle cases where the pass-through rate is not constant, the relevant pass-through rate to be used in the condition $PTR_N \times REC_N \times M > S$ is the pass-through rate for this discrete cost change. Subsequent steps in the iterative procedure only required that the pass-through rate on *additional* cost increases (for all products in the candidate market) be non-negative, a very mild assumption.

Regarding the group recapture rate REC_N, suppose now that this rate varies with price, Z, according to $REC_N(Z)$. The condition $PTR_N \times REC_N \times M > S$ can be based on the group recapture rate measured at pre-merger prices, $REC_N(P)$. However, the iterative procedure uses recapture at higher prices to calculate the tax rates according to $T^{k+1} = REC_N(P^k) \times (P^k - C)$. The proof remains valid so long as the tax rates are non-decreasing, $T^{k+1} \geq T^k$. A sufficient condition for this is that the function $REC_N(Z) \times (Z - C)$ be non-decreasing in Z. In practice, Proposition 1 can be applied using the group recapture rate associated with prices in the range between the pre-merger price P and the price after imposition of the SSNIP, $P(1+S)$.

B. PROOF OF PROPOSITION 2

Proposition 2: In the symmetric case, if $PTR_N \times REC_N \times [M + S] < S$, then Products $1, \ldots, N$ do *not* satisfy the hypothetical monopolist test.

This proof proceeds along very similar lines to the proof of Proposition 1. However, we imagine that before beginning the iterative procedure used there, all prices are first raised by a SSNIP, according to orders issued by corporate headquarters: $P^0 = P(1+S)$. The intuitive idea is that the condition given in Proposition 2 ensures downward pricing pressure, and hence downward price movement, when that edict is relaxed and the iterative process of calculating cannibalization taxes and induced prices begins from P^0. The first-round tax is then calculated based on P^0:

$$T^1 = REC_N \times (P^0 - C).$$

Since $PTR_N \times REC_N \times [M + S] < S$, we know that each divisional manager, facing a tax of T^1 (and knowing that other divisions face the same tax), will set a price *less* than $P(1+S)$, so $P^1 < P^0$. As in the proof of Proposition 1, the tax at the next round is set according to

$$T^2 = REC_N \times (P^1 - C).$$

Since $P^1 < P^0$, we must have $T^2 < T^1$, so the prices at the next round are lower: $P^2 < P^1$. Repeating this procedure until convergence proves the proposition. If the pass-through rate and/or the group recapture rate vary with cost and price in the relevant ranges, similar conditions discussed in the proof of Proposition 1 can be used here to ensure that the iterative step still applies.

C. PROOF OF PROPOSITION 3

Proposition 3: If

$$PTR_1 \times [D_{12}M_2 \frac{P_2}{P_1} + \ldots + D_{1N}M_N \frac{P_N}{P_1}] > S,$$

then Products $1, \ldots, N$ satisfy the hypothetical monopolist test.

The proof of Proposition 3 is also a variation of the proof of Proposition 1. The first-round tax on Product 1 is given by

$$T_1^1 = D_{12}(P_2 - C_2) + \ldots + D_{1N}(P_N - C_N).$$

Analogous taxes are imposed on Products $2, \ldots, N$. We assume that the products in the candidate market all earn positive margins and that they are all substitutes for each other, so each diversion ratio is positive. Therefore, each tax is positive. We also assume non-negative cross-pass-through rates in the relevant range of costs: an increase in the cost of one product increases or leaves unchanged the prices of the other products. With these assumptions, and using the condition in Proposition 3, we know that the first-round price for Product 1 is at least a SSNIP larger than the pre-merger price of Product 1.

To complete the proof, it is sufficient to show that T_1^k is non-decreasing in k. Since

$$T_1^{k+1} = D_{12}(P_2^k - C_2) + \ldots + D_{1N}(P_N^k - C_N),$$

it is sufficient to show that $D_{1i}(P_i^k - C_i)$ is non-decreasing in P_i for $i = 2, \ldots, N$. This is analogous to the sufficient condition in the proof of Proposition 1 that $REC_N(Z) \times (Z - C)$ be non-decreasing in Z.

D. Pass-Through Rates in Perfectly Competitive Markets

Suppose that supply is given by the function $X(p)$ per unit of productive capacity, and normalize the total level of capacity in the industry to be unity. We consider the impact of a small upward shift c in marginal costs that applies to a fraction k of the total industry capacity. Aggregate industry supply-demand balance requires:

$$(1-k)\,X(p)+kX(p-c)=D(p),$$

where $D(p)$ is demand. Fixing k, treating p as a function of c, and differentiating with respect to c yields:

$$0=-kX'(p-c)+\frac{dp}{db}\left[(1-k)\,X'(p)+kX'(p-c)-D'(p)\right].$$

Now setting $c=0$, we get the pass-through rate for small selective marginal-cost shocks:

$$\left.\frac{dp}{dc}\right|_{c=0}=k\frac{X'(p)}{X'(p)-D'(p)}.$$

The elasticity of supply is defined as $E_S=pX'(p)/X(p)$ and the elasticity of demand is defined as $E_D=-pD'(p)/D(p)$. Using $D(p)=X(p)$, we get

$$\left.\frac{dp}{dc}\right|_{c=0}=k\frac{E_S}{E_S+E_D}.$$