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Chapter 55

UNILATERAL COMPETITIVE EFFECTS OF HORIZONTAL MERGERS I: BASIC CONCEPTS AND MODELS

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Horizontal mergers give rise to unilateral anticompetitive effects if they cause the merged firm to act less intensely competitive than the merging firms, while nonmerging rivals do not alter their competitive strategies. This chapter describes the economic theory underlying unilateral competitive effects from mergers and the quantitative application of this theory in predicting the unilateral price effects of proposed mergers. This chapter focuses on unilateral effects in homogeneous products industries described by the Cournot model and unilateral effects in differentiated products industries described by the Bertrand model.

1. Introduction

Horizontal mergers give rise to unilateral anticompetitive effects if they cause the merged firm to act less intensely competitive than the merging firms, while nonmerging rivals do not alter their competitive strategies.[1] Unilateral effects contrast with coordinated effects arising if a merger induces rivals to alter their competitive strategies, resulting in some form of coordination or reinforcement of ongoing coordination. Since early 1990s, few merger challenges by the federal enforcement agencies were based entirely on coordinated effects.[2]

Unilateral merger effects are simplest when there are no nonmerging rivals—the case of merger to monopoly. To whatever extent premerger competition produces lower prices or higher outputs than those under monopoly, the merger raises price and reduces output by eliminating that competition. Other applications of unilateral effects are variations on the same theme, which depend on the nature of the competitive process in a particular industry.[3] The discussion below first introduces the game theory approach

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1. For introductions to unilateral effects analysis, see Jonathan B. Baker, *Unilateral Competitive Effects Theories in Merger Analysis*, ANTITRUST, Spring 1997, at 21; Carl Shapiro, *Mergers with Differentiated Products*, ANTITRUST, Spring 1996, at 23. For a more detailed and more technical treatment of this material, see Gregory J. Werden & Luke M. Froeb, *Unilateral Competitive Effects of Horizontal Mergers*, *in* HANDBOOK OF ANTITRUST ECONOMICS 43 (Paolo Buccirossi ed., 2008).
2. *See* William J. Baer, Deborah L. Feinstein & Randal M. Shaheen, *Taking Stock: Recent Trends in U.S. Merger Enforcement*, ANTITRUST, Spring 2004, at 15, 18.
3. The leading antitrust law treatise lists three categories of unilateral effects theories: "mergers to monopoly; dominant firm's acquisition of a nascent rival; and mergers producing smaller groupings of sales in which competitive effects can be realized." 4 PHILLIP E. AREEDA, HERBERT HOVENKAMP & JOHN L. SOLOW, ANTITRUST LAW ¶ 908b2, at 50 (2d ed. 2006). Economics provides several distinct theories within, or in addition to, the rather obscure third category.

to the analysis of oligopoly then briefly reviews the case law on unilateral merger effects. After these preliminaries, the analysis of unilateral effects is presented in detail within the context of two classic oligopoly models.

2. The basic economics of unilateral effects

2.1. Game theory concepts and two classic oligopoly models

Economists analyze oligopoly using the tools of game theory, so understanding the basics of oligopoly theory requires familiarity with basic concepts of game theory. A game is defined by its players (e.g., the competitors), the actions they may take (e.g., setting prices or setting quantities), and the equilibrium concept that indicates what actions are best and determines the outcome of the game. The key equilibrium concept employed in economics is *Nash, noncooperative equilibrium*. A Nash, noncooperative equilibrium is a set of actions by players such that no player has an incentive to alter its action in light of the actions being taken by the other players.[4]

Unilateral merger effects arise in a broad class of oligopoly games with Nash, noncooperative equilibria, including the two classic oligopoly models developed in the nineteenth century. These models posit "simultaneous-move," "one-shot" games, meaning that the game is played just once and all players select their actions at the same time. Like many game theoretic economic models, these two classic oligopoly models predict an outcome—the equilibrium prices and quantities—while abstracting entirely from the process through which players achieve that outcome.

The first formal model of oligopoly was introduced by Antoine Augustin Cournot's 1838 book.[5] The usual version of the Cournot model, and the only one considered here, features a single, homogeneous product.[6] The actions of Cournot competitors are the quantities they produce, so a Cournot-Nash equilibrium is a set of quantities such that each competitor is happy with its quantity, given its rivals' quantities.

The second oldest oligopoly model was introduced by Joseph Louis François Bertrand in an 1883 review of Cournot's book.[7] Bertrand argued that it was more realistic for competitors to choose prices, rather than quantities. Thus, the actions of Bertrand competitors are their prices, and a Bertrand-Nash equilibrium is a set of prices such that each competitor is happy with its price, given its rivals' prices. The Bertrand

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4. This concept was introduced by mathematician John F. Nash, Jr., and it earned him a share of the 1994 Nobel Memorial Prize in Economics. Nash's main contribution on the subject is John Nash, *Non-Cooperative Games*, 54 ANNALS OF MATHEMATICS 286 (1951), *reprinted in* COURNOT OLIGOPOLY 82 (Andrew F. Daughety ed., 1988).
5. RESEARCHES INTO THE MATHEMATICAL PRINCIPLES OF THE THEORY OF WEALTH (Nathaniel T. Bacon trans., Augustus M. Kelley, 1971) (1838).
6. For a simple presentation of this model, see, e.g., DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 161-71 (4th ed. 2005). For more technical treatments, see Carl Shapiro, *Theories of Oligopoly Behavior*, *in* 1 HANDBOOK OF INDUSTRIAL ORGANIZATION 329, 333-39 (Richard Schmalensee & Robert D. Willig eds., 1989), and XAVIER VIVES, OLIGOPOLY PRICING: OLD IDEAS AND NEW TOOLS ch. 4 (1999).
7. *Review of "Théorie Mathématique de la Richesse Sociale," and "Recherches sur les Principes Mathématiques de la Théorie de Richesse,"* 67 JOURNAL DES SAVANTS 499 (1883). A modern translation by James Friedman appears in COURNOT OLIGOPOLY 73 (Andrew F. Daughety ed., 1988).

model is applied principally to differentiated products industries,[8] and differentiated products are presumed below when the Bertrand model is referenced.[9]

Although the Cournot and Bertrand models are straightforward applications of Nash, noncooperative equilibrium, economists have understood the models this way for only a generation. For quite a long time, the models were understood to posit irrational behavior: As the Cournot model in particular was presented verbally and mathematically, each competitor assumed that its rivals would not alter their quantities in response to its quantity changes. That assumption, however, was flatly inconsistent with the behavior of competitors in the model.[10] Understood as presuming irrational behavior, the model was consistently rejected. But after Nash's work on game theory entered economics' mainstream, "Cournot [was] reread and reinterpreted," and Cournot equilibrium is now viewed as the product of fully rational behavior.[11]

As explained in detail below, the Cournot and Bertrand oligopoly models predict that mergers without offsetting efficiencies produce unilateral anticompetitive effects. In the Bertrand model, a merger combining two competing brands of a differentiated consumer product, and not reducing costs, necessarily leads to price increases, even if only very small price increases. The merged firm accounts for the increase in sales of either of the two brands that results from an increase in the price of the other, and therefore finds it in its unilateral self-interest to raise the prices of both.

2.2. A formal definition of unilateral effects

Before returning to the Cournot and Bertrand models, it is useful to define unilateral effects precisely by considering a very abstract oligopoly model in which n competitors simultaneously take actions that can be represented by numbers. The Cournot and Bertrand models are the special cases of this general model in which competitors' actions are their quantities and prices. Let

$$a_i = \text{the action taken by competitor } i$$

$$\boldsymbol{a}_{-i} = \text{the actions taken by competitor } i\text{'s } n-1 \text{ rivals}$$

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8. With homogeneous products, there may be no Bertrand-Nash equilibrium. *See* 1 F.Y. EDGEWORTH, PAPERS RELATING TO POLITICAL ECONOMY 116-21 (1925). If there is an equilibrium, it exhibits competitive prices when there are few competitors, unlike the Cournot-Nash equilibrium. Attempts have been made to combine the Cournot and Bertrand models by having competitors first make investment decisions that determine their capacities, then choose prices. Under some conditions, the equilibrium is the same as in the Cournot model. *See* David M. Kreps & José A. Scheinkman, *Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes*, 14 BELL J. ECON. 326 (1983).
9. For presentations of the Bertrand model with differentiated products, see Shapiro, *supra* note 6, at 343-48; VIVES, *supra* note 6, ch. 5.
10. This critique appeared in the first analysis of Cournot's model written in English. Irving Fisher, *Cournot and Mathematical Economics*, 12 Q.J. ECON. 119, 126-27 (1898).
11. Robert J. Leonard, *Reading Cournot, Reading Nash: The Creation and Stabilization of the Nash Equilibrium*, 104 ECON. J. 492, 505 (1994). A Cournot-Nash equilibrium exhibits rational expectations in the sense that competitors actually do what their rivals expect them to do. *See* Andrew F. Daughety, *Reconsidering Cournot: The Cournot Equilibrium Is Consistent*, 16 RAND J. ECON. 368 (1985).

$\Pi^i(a_i, \boldsymbol{a}_{-i})$ = the profit function for competitor *i*, and

$\Pi^i_i(a_i, \boldsymbol{a}_{-i})$ = the "partial derivative" of $\Pi^i(a_i, \boldsymbol{a}_{-i})$ with respect a_i

A few explanatory remarks are in order. First, the actions of competitor *i*'s rivals are denoted by the bold face symbol $\boldsymbol{a}_{-i}$ to reflect that this is a list of quantities or "vector." Second, competitor *i*'s profit is written as a function of both its action and the actions of its rivals to highlight the interdependence that characterizes oligopoly; each competitor's actions affect all of its rivals. Third, the "derivative" of a function at any point is its slope, and the "partial derivative" of a function of several variables is the slope of a cross section of that function, holding constant all of the variables except the one with respect to which the derivative is taken. Thus, $\Pi^i_i(a_i, \boldsymbol{a}_{-i})$ indicates the rate of change of competitor *i*'s profit as competitor *i* changes its own action, holding constant the actions of its rivals.

Each competitor maximizes its profit by selecting an action such that a small change in the action would not increase its profit. For competitor *i*'s profit to be maximized therefore requires

$$\Pi^i_i(a_i, \boldsymbol{a}_{-i}) = 0$$

This equation is referred to as competitor *i*'s *first-order condition*. It is assumed here that only one action solves this equation for any actions by rivals. Competitor *i*'s first-order condition defines its best response to any actions by its rivals, and solving the first-order condition for a_i as a function of $\boldsymbol{a}_{-i}$ yields competitor *i*'s *best-response function*. The competitors in this oligopoly game find themselves in Nash, noncooperative equilibrium if all *n* operate on their best-response functions, so no competitor has an incentive to alter its action. The equilibrium is computed by simultaneously solving the *n* first-order conditions. Although the partial derivative in each first-order condition treats rivals' actions as constant, competitors are not assumed naively to treat rivals' actions as fixed. In fact, competitors make no assumptions about rival's response to their actions.

The merger of competitors *i* and *j* produces a new competitor choosing a_i and a_j to maximize the sum of Π^i and Π^j. The merger alters the optimal choice of a_i and a_j because the merged competitor accounts for the effect of a_i on Π^j and the effect of a_j on Π^i. Unless both effects are negligible, the merger affects the choice of both a_i and a_j. The merger, thus, gives rise to anticompetitive effects. Moreover, changes in a_i and a_j lead nonmerging competitors to alter their actions as well. The postmerger equilibrium fully reflects all competitors' responses to others' responses and so forth.

What makes the merger anticompetitive is that it internalizes the competition between the merging competitors and thereby causes them to alter their actions. What makes the anticompetitive effect of the merger "unilateral" is that the actions of nonmerging firms are determined by the same, Nash-equilibrium, best-response functions before and after the merger. The term "unilateral" is applied even though the nonmerging firms do not take the same actions after the merger that they did before it, and even if the changes in their actions increase the merged firm's profit.

2.3. The emergence of unilateral effects analysis

The basic approach to merger analysis under Section 7 of the Clayton Act was crafted by the Supreme Court beginning in the late 1940s. The Court's 1948 *Columbia Steel* decision introduced the term "relevant market" and was the first horizontal merger case to focus on market shares.[12] Congressional dissatisfaction with the outcome of that case was a major factor precipitating amendment of Section 7 in 1950.[13] The basic principles followed by the lower courts today were laid out by the Supreme Court in the first two horizontal merger cases decided on the merits by the Court under the 1950 amendment.

Brown Shoe emphasized market shares and consequently held that "the proper definition of the market is a 'necessary predicate' to an examination of the competition that may be affected by the horizontal aspects of the merger."[14] *Philadelphia National Bank* further held that

> a merger which produces a firm controlling an undue percentage share of the relevant market, and results in a significant increase in the concentration of firms in the market, is so inherently likely to lessen competition substantially that it must be enjoined in the absence of evidence clearly showing that the merger is not likely to have such anticompetitive effects.[15]

The Court has not had occasion to revisit these decisions, nor have the courts of appeals greatly elaborated these themes.[16]

Philadelphia National Bank indicated that a market-share-based presumption was "fully consonant with economic theory," but the only "economic theory" cited was that "[c]ompetition is likely to be greatest when there are many sellers none of which has any significant market share."[17] Moreover, the presumption did not implement economic theory so much as it avoided economic theory. The Court justified the presumption on the grounds that "intense congressional concern with the trend toward concentration warrants dispensing, in certain cases, with elaborate proof of market structure, market behavior, or probable anticompetitive effects."[18]

Had the Court embraced economic theory, the Cournot and Bertrand models would not have been any part of that theory. As noted above, they were out of favor with economists during the formative era for merger enforcement policy in the United States.

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12. United States v. Columbia Steel Co., 334 U.S. 495, 508, 512-13 & n.10, 519-20, 527 (1948).
13. The Celler-Kefauver Act of 1950 (ch. 1184, 64 Stat. 1125) amended the Clayton Act to prohibit mergers the effect of which "may be substantially to lessen competition . . . in any line of commerce in any section of the country." 15 U.S.C. § 18.
14. Brown Shoe Co. v. United States, 370 U.S. 294, 322 n.38, 335, 343 (1962).
15. United States v. Phila. Nat'l Bank, 374 U.S. 321, 363 (1963).
16. The most recent merger decisions by appellate courts continue to follow the *Philadelphia National Bank* approach, holding, for example: "First the government must show that the merger would produce a firm controlling an undue percentage share of the relevant market, and would result in a significant increase in the concentration of firms in that market. Such a showing establishes a presumption that the merger will substantially lessen competition." FTC v. H.J. Heinz Co., 246 F.3d 708, 715 (D.C. Cir. 2000) (citations and internal quotation omitted).
17. *Phila. Nat'l Bank*, 374 U.S. at 363.
18. *Id.*

Only coordinated effects were predicted by the then-prevailing view of oligopoly theory, which maintained that cooperation would tend to emerge spontaneously when the number of competitors was sufficiently small.[19] As late as the mid 1980s, Judges Robert Bork and Richard Posner were in the mainstream when they explained the rationale of horizontal merger law using only a coordinated effects theory.[20]

In the years immediately following *Philadelphia National Bank*, the Court endorsed nearly every anticompetitive effects theory presented to it. Of particular interest may be *Consolidated Foods*, in which the Court upheld a challenge premised on a danger of "[r]eciprocity in trading as a result of an acquisition."[21] Reciprocity is not a Section 7 theory likely to be accepted by a court today, but it has the distinction of being a unilateral effects theory. The actions of rivals play absolutely no role in producing the feared anticompetitive effect. The Supreme Court's merger decisions, thus, plainly embrace at least some unilateral effects theories.

By the 1992 release of the *Horizontal Merger Guidelines*,[22] game theory had come to dominate economists' thinking about oligopoly,[23] and the 1992 *Merger Guidelines* drew heavily on the teachings of modern oligopoly theory. The 1992 *Merger Guidelines* identified two general categories of competitive effects theories, which were dubbed "coordinated" and "unilateral."[24] The 1992 *Merger Guidelines* also articulated factors to be considered when evaluating the relevance of each theory in any particular case, and when assessing likely magnitude of the anticompetitive effect under each particular theory.[25]

The 1992 *Merger Guidelines* explain that unilateral effects "can arise in a variety of different settings," which "differ by the primary characteristics that distinguish firms and shape the nature of their competition."[26] The 1992 *Merger Guidelines* divide these settings into two classes. In one class, products are differentiated, and firms are distinguished primarily by the products they offer. In the other, the product is homogeneous, and firms are distinguished primarily by their production capacities.[27]

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19. *See* EDWARD H. CHAMBERLIN, THE THEORY OF MONOPOLISTIC COMPETITION ch. 3 (8th ed. 1962) (1933); WILLIAM FELLNER, COMPETITION AMONG THE FEW (1949); Edward H. Chamberlin, *Duopoly: Value Where Sellers Are Few*, 44 Q.J. ECON. 63 (1929).
20. *See* Hosp. Corp. of Am. v. FTC, 807 F.2d 1381, 1386 (7th Cir. 1986) (Posner, J.) ("the worry is that [an acquisition] may enable the acquiring firm to cooperate (or cooperate better) with other leading competitors on reducing or limiting output"); FTC v. PPG Indus., 798 F.2d 1500, 1503 (D.C. Cir. 1986) (Bork, J.) (the concern with increased concentration "rests upon the theory that, where rivals are few, firms will be able to coordinate their behavior, either by overt collusion or implicit understanding, in order to restrict output").
21. FTC v. Consol. Foods Corp., 380 U.S. 592, 595 (1965).
22. U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, HORIZONTAL MERGER GUIDELINES (1992) (with Apr. 8, 1997 revisions to Section 4 on efficiencies) [hereinafter 1992 MERGER GUIDELINES], *reprinted in* 4 Trade Reg. Rep. (CCH) ¶ 13,104.
23. *See, e.g.*, Franklin M. Fisher, *Games Economists Play: A Noncooperative View*, 20 RAND J. ECON. 113, 113 (1989) ("oligopoly theory . . . is totally dominated by the game-theoretic approach").
24. 1992 MERGER GUIDELINES, *supra* note 22, § 2.
25. *Id.*
26. *Id.* § 2.2.
27. *Id.* §§ 2.21-2.22.

Within the latter class are the Cournot and dominant firm models.[28] Within the former class is the Bertrand model.[29] Auction and bargaining models, which are discussed in the next chapter, generally fall in the former class as well.

Since the release of the 1992 *Merger Guidelines*, the federal enforcement agencies have brought many unilateral effects cases, few of which were contested.[30] In two cases involving differentiated consumer products, district courts enjoined mergers on the basis of unilateral effects theories.[31] District courts have rejected several unilateral-effects-based merger challenges but have not questioned the legitimacy of the unilateral effects theories.[32] Only the *Oracle* decision extensively analyzed unilateral effects, and it concentrated on unilateral effects with differentiated products. Consequently, *Oracle* is discussed below in the context of the Bertrand model.

3. Unilateral merger effects in Cournot industries

3.1. Mergers in the basic Cournot model

In the only version of the Cournot model considered here, there is a single, homogeneous product. The market price for that product is determined by the aggregate

28. *See* U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, COMMENTARY ON THE HORIZONTAL MERGER GUIDELINES 25 (2006) [hereinafter MERGER GUIDELINES COMMENTARY]. The dominant firm model was proposed by Karl Forchheimer, *Theoretishes zum unvollständigen Monopole*, 32 JAHRBUCH FÜR GESETZGEBUNG, VERWALTUNG UND VOLKSWIRTSCHAFT 1 (1908). It posits that all firms but one in an industry act as a "competitive fringe," producing up to the point at which their marginal costs equal the market price. The remaining, dominant, firm acts as a monopolist with respect the portion of total industry demand that the competitive fringe does not supply. The dominant firm model is mentioned as basis for analyzing unilateral effects in *United States v. Oracle, Inc.*, 331 F. Supp. 2d 1098, 1113 (N.D. Cal. 2004), but the Cournot model is not. The dominant firm model is not presented here primarily because its predictions differ little from those of the Cournot model if one competitor is large and its rivals are tiny.

29. *See* MERGER GUIDELINES COMMENTARY, *supra* note 28, at 25. The *Oracle* decision discussed at length what economists call the Bertrand model, but the court referred instead to the model of monopolistic competition. 331 F. Supp. 2d at 1113. In economics, the latter term normally is applied only to a model with free entry, and such a model is used to examine whether and how the equilibrium number of products or competitors departs from the social optimum.

30. For brief summaries of nine merger analyses by the agencies employing models discussed in this chapter, see MERGER GUIDELINES COMMENTARY, *supra* note 28, at 27-31. Challenges to six of the proposed mergers were settled by consent decrees, and the agencies took no action against remaining three.

31. *See* FTC v. Swedish Match, 131 F. Supp. 2d 151, 169 (D.D.C. 2000) (finding that a "unilateral price increase by Swedish Match is likely after the acquisition" and recounting the unilateral effects analysis by the FTC's expert economist); FTC v. Staples, Inc., 970 F. Supp. 1066, 1083 (D.D.C. 1997) ("Since prices are significantly lower in markets where Staples and Office Depot compete, eliminating this competition with one another would free the parties to charge higher prices in those markets . . . .").

32. *See* United States v. Long Island Jewish Med. Ctr., 983 F. Supp. 121, 137-40, 142-45 (E.D.N.Y. 1997) (rejecting plaintiff's proposed product market and finding the predicted price increase unsupported by the evidence); New York v. Kraft Gen. Foods, 926 F. Supp. 321, 333-35, 363, 365-66 (S.D.N.Y. 1995) (rejecting plaintiff's proposed product market and finding the merger would have little effect); United States v. Gillette Co., 828 F. Supp. 78, 83-85 (D.D.C. 1993) (rejecting plaintiff's proposed product market and finding entry and other forces would discipline pricing).

output of all of its producers through the industry's demand curve; the more produced, the lower the price must be to clear the market. Cournot competitors are completely characterized by their cost functions, and a Cournot industry is completely characterized by its competitors and demand curve.

The actions of Cournot competitors are the quantities they produce. Each firm maximizes profit just as in the general model of Section 2.2 by equating to zero the derivative of its profit function with respect to its output. These equations are the first-order conditions defining the Cournot-Nash equilibrium. Let

m_i = firm i's price-cost margin (price minus marginal cost, all divided by price)

s_i = firm i's share of total industry output,[33] and

ε = the industry's elasticity of demand,[34] defined to be a positive number.

Using this notation, firm i's first-order condition can be written

$$m_i = s_i / \varepsilon$$

This condition indicates one important property of a Cournot industry: The larger a firm's market share, the larger is its price-cost margin (and the lower its marginal cost).

Multiplying both sides of each firm's first-order condition by its market share, and summing over all firms, yields an equilibrium condition for a Cournot industry:

$$m = HHI / \varepsilon$$

In this condition,

m = the share-weighted industry average price-cost margin, and

HHI = the Herfindahl-Hirschman Index of output concentration.[35]

Because m is the average extent to which price is competed down to marginal cost, it is an index of the intensity of competition. Thus, this last condition indicates that the intensity of competition is related to concentration measure used by the 1992 *Merger Guidelines*.

If a merger affected neither the elasticity of industry demand nor the industry average marginal cost, the industry equilibrium condition could be manipulated to yield the proportionate increase in price following a Cournot merger. If HHI before the merger is denoted HHI_{pre} and HHI after the merger is denoted HHI_{post}, the proportionate price increase is

$$(HHI_{post} - HHI_{pre}) / (\varepsilon - HHI_{post})$$

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33. Both m_i and s_i are expressed as decimal fractions. If price were 2 and marginal cost 1, m_i would be .5, and if firm i produced 10 units out of a total of 50, s_i would be .2.

34. The elasticity of demand measures the responsiveness of the quantity consumers purchase to a change in price. Specifically, it is the proportionate change in the quantity consumed divided by the proportionate change in price that induced the quantity change. Thus, if a 1% increase in price induces a 2% reduction in the quantity purchased, the elasticity of demand is 2.

35. HHI is the sum of the squares of the s_i, and like the s_i, HHI is expressed as a decimal fraction. An HHI of 1800 per the 1992 *Merger Guidelines*, *supra* note 22, § 1.5, translates into an HHI of .18.

If *HHI* increases from .2 to .25, and the demand elasticity is 1.25, the proportionate increase in price is .05, or 5 percent. This formula, however, is not useful as a predictor of the price effects of proposed mergers because HHI_{post} is not the "postmerger HHI" of the 1992 *Merger Guidelines* and cannot be determined at the time a proposed merger is reviewed.

The 1992 *Merger Guidelines*' postmerger HHI is HHI_{pre} plus the "change in the HHI," defined as twice the product of the market shares of the merging firms. In other words, the postmerger HHI is what HHI_{post} would be if the merger had no effect on market shares. But an anticompetitive merger in a Cournot industry necessarily affects shares significantly, and HHI_{post} is the actual sum of the squares of the output shares after the merger, which are unobservable prior to the merger. Moreover, industry average marginal cost cannot be the same before and after a merger unless all firms in the industry have the same marginal cost, which does not vary with output. Finally, a merger significantly affecting the equilibrium price, mostly likely also significantly affects the equilibrium elasticity of demand.

Mergers in Cournot industries always cause an increase in price unless they generate synergies that reduce marginal cost.[36] Absent synergies, the merged firm produces less than merging firms had produced; the nonmerging firms increase their production; but the net effect is a lower total production and hence a higher price.[37]

The magnitude of the marginal-cost reduction necessary to prevent a price increase following a merger in a Cournot industry can be expressed in terms of the premerger demand elasticity and premerger market shares of the merging firms.[38] Expressed as a proportion of the share-weighted average of the merging firms' premerger marginal costs, the required reduction in marginal cost is

$$2s_i s_j / [\varepsilon (s_i + s_j) - (s_i^2 + s_j^2)]$$

Expressed as a proportion of the premerger price, the required reduction in marginal cost is

$$2s_i s_j / \varepsilon (s_i + s_j)$$

If the merging firms are identical, so $s_i = s_j = s$, the former expression simplifies to $s/(\varepsilon - s)$ and the latter to s/ε. This final expression equals the premerger price-cost margin of both merging firms and yields a handy rule of thumb: To prevent a price increase following a merger in a Cournot industry, merger synergies must reduce the

36. *See* Joseph Farrell & Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis*, 80 AM. ECON. REV. 107 (1990).

37. With linear demand and cost functions that make each firm's marginal cost inversely proportional to its capital stock or productive capacity, it has been shown that a larger change in the HHI from a merger implies a larger price increase, provided that market shares are assigned on the basis of capacity, rather than output. *See* Gregory J. Werden, Comment, *Horizontal Mergers*, 81 AM. ECON. REV. 1002 (1991).

38. *See* Luke M. Froeb & Gregory J. Werden, *A Robust Test for Consumer Welfare Enhancing Mergers Among Sellers of a Homogeneous Product*, 58 ECON. LETTERS 367 (1998).

merged firm's marginal cost by at least as much as the premerger price exceeds the merging firms' marginal costs.

3.2. Other insights on acquisitions in Cournot industries

Academic literature on mergers in Cournot industries has highlighted the issue of profitability. It was first observed that, with linear demand, equal marginal costs across competitors that are invariant to output, and no constraints on capacity, a merger is profitable only for merging firms accounting for at least 80 percent of industry production.[39] But these assumptions produce an unrealistic model because a merger simply destroys the higher cost merging firm, and nothing of value is acquired. Because real world corporate acquisitions rarely are designed merely to destroy assets, the Cournot model is apt to be of interest to merger policy only if competitors' marginal costs increase as their outputs increase. If that is true, there is substantial scope for profitable mergers in Cournot industries.[40] There also is scope for profitable mergers in Cournot industries when demand is convex, rather than linear.[41] Finally, the profitability of a real world merger may derive from sources outside the model, i.e., synergies in businesses of the merging firms other than those producing the anticompetitive effects.

The impact of a partial equity interest in a rival also has been analyzed in the Cournot model.[42] A critical insight is that a purely financial interest causes a unilateral anticompetitive effect, even though the interest does not provide a means to control or influence the rival's actions. Owning a financial interest in a rival gives a competitor an incentive to restrict its own production and thereby drive up the industry price.

Economic research has begun to explore the incentive for, and effects of, entry following merger in a Cournot industry. This research suggests that mergers are unlikely to induce entry, even if they result in significant price increases, if entry necessarily results in a net price reduction, as is likely in a Cournot industry.[43] Other

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39. *See* Steven W. Salant, Sheldon Switzer & Robert J. Reynolds, *Losses from Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium*, 98 Q.J. ECON. 185 (1983).

40. *See* Martin K. Perry & Robert H. Porter, *Oligopoly and the Incentive for Horizontal Merger*, 75 AM. ECON. REV. 219 (1985).

41. *See* David A. Hennessy, *Cournot Oligopoly Conditions under which Any Horizontal Merger Is Profitable*, 17 REV. INDUS. ORG. 277 (2000); Ramon Faulí-Oller, *On Merger Profitability in a Cournot Setting*, 54 ECON. LETTERS 75 (1997).

42. *See, e.g.*, Joseph Farrell & Carl Shapiro, *Asset Ownership and Market Structure in Oligopoly*, 21 RAND J. ECON. 275 (1990); David Flath, *Horizontal Shareholding Interlocks*, 13 MANAGERIAL & DECISION ECON. 75 (1992); Daniel P. O'Brien & Steven C. Salop, *Competitive Effects of Partial Ownership: Financial and Corporate Control*, 67 ANTITRUST L.J. 559 (2000); Robert J. Reynolds & Bruce R. Snapp, *The Competitive Effects of Partial Equity Interests and Joint Ventures*, 4 INT'L J. INDUS. ORG. 141 (1986).

43. *See* Gregory J. Werden & Luke M. Froeb, *The Entry-Inducing Effects of Horizontal Mergers*, 46 J. INDUS. ECON. 525 (1998). Other research finds that, when entry can leave the postmerger, postentry price above the premerger level, mergers are profitable, and thus occur, only if any entry does leave price above the premerger level. *See* David Spector, *Horizontal Mergers, Entry, and Efficiency Defenses*, 21 INT'L J. INDUS. ORG. 1591 (2003).

research suggests that, over the very long run, Cournot competition in a world with investment, entry, exit, and mergers is likely to result in mergers with price-increasing effects not reversed by investment or entry.[44]

3.3. When does a Cournot model "fit" an industry?

In *Daubert*, the Supreme Court declared that expert testimony is admissible only if it "is sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute," i.e., only if there is a good "fit" between the testimony and the pertinent inquiry.[45] As one court of appeals declared, *Daubert* requires a "thorough analysis of the expert's economic model," which "should not be admitted if it does not apply to the specific facts of the case."[46] The same discipline is appropriate outside the courtroom whenever a particular oligopoly model is given significant weight in the evaluation of the likely competitive effects of a merger.[47]

Properly evaluating the fit of an oligopoly model draws on the full array of qualitative and quantitative evidence developed in the case, but the key test of a model used to predict the likely unilateral price effects of a merger is how well the model explains premerger pricing. As noted in Section 3.1, the Cournot model predicts that the price-cost margin of each competitor equals its output share divided by the industry elasticity of demand. It should not be difficult to determine whether the average level of margins in an industry is roughly as predicted by the Cournot model and whether larger firms have larger margins, as predicted.[48] In a nonmerger case, a court held that a "Cournot model does not 'fit' the economic reality" of an industry with highly unequally sized firms but not the significant differences in margins the Cournot model predicts.[49]

To fit the facts of a case, an oligopoly model also must reflect critical features of the competitive landscape, such as whether the product is homogeneous or highly differentiated. Hence, the Cournot model considered here poorly fits a consumer goods industry in which brands are important. An oligopoly model, however, need not reflect the institutional details of an industry. In particular, the fact that competitors in an industry do not literally set outputs does not imply that the Cournot model cannot be

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44. *See* Gutam Gowrisankaran, *A Dynamic Model of Endogenous Horizontal Mergers*, 30 RAND J. ECON. 56 (1999).
45. Daubert v. Merrell Dow Pharms., 509 U.S. 579, 591 (1993) (quoting United States v. Downing, 753 F.2d 1224, 1242 (3d Cir. 1985)).
46. Concord Boat v. Brunswick Corp., 207 F.3d 1039, 1055-56 (8th Cir. 2000).
47. *See* Gregory J. Werden, Luke M. Froeb & David T. Scheffman, *A* Daubert *Discipline for Merger Simulation*, ANTITRUST, Summer 2004, at 89.
48. Empirical studies indicate that average margins in many industries are roughly as predicted by the Cournot model. *See* Micha Gisser & Raymond D. Sauer, *The Aggregate Relation between Profits and Concentration Is Consistent with Cournot Behavior*, 16 REV. INDUS. ORG. 229 (2000); Luke M. Froeb & Gregory J. Werden, Endogeneity in the Concentration-Price Relationship: Causes and Consequences 12-13 (U.S. Dep't of Justice, Antitrust Division, Economic Analysis Group Discussion Paper 91-7, July 1, 1991).
49. Heary Bros. Lightning Prot. Co. v. Lightning Prot. Inst., 287 F. Supp. 2d 1038, 1066-68 (D. Ariz. 2003).

useful in the analysis of a merger. It is essential that a model accurately predict but not that it accurately describe.[50]

Making an economic model fit the specific quantitative facts of a case is a process called "calibration." Calibrating a Cournot model in a merger case fits it to premerger market shares and the elasticity of demand for the market (which is estimated, inferred, or just assumed). In a notorious nonmerger case, the court held that a Cournot model specifying equally sized competitors was "not grounded in the economic reality" of an industry in which competitors were far from equal in size.[51]

4. Unilateral merger effects in Bertrand industries

4.1. Mergers in the basic Bertrand model

The only version of the Bertrand model considered here features competing differentiated products, which are referred to as "brands" because consumer products typically are involved. Each competitor maximizes profit, just as in the general model of Section 2.2, by equating to zero the derivative of its profit function with respect to its price (or each of the partial derivatives of its profit function with respect to each of its prices, if it sells multiple brands). The Bertrand-Nash equilibrium is the set of prices that simultaneously solves the first-order conditions for all competing brands.

If each competitor has a single brand,

ε_i = the elasticity of demand for brand i, and

m_i = the price-cost margin of brand i,

the first-order condition for profit maximization of brand i can be written as

$$m_i = 1/\varepsilon_i$$

This condition is termed the "inverse-elasticity rule" or the "Lerner condition."[52] Exactly the same first-order condition defines the profit-maximizing price charged by a monopolist. The reason is that each Bertrand competitor acts just as a monopolist in setting the price for its particular brand. Mathematically, this is true even if the brand has good substitutes and therefore highly elastic demand.

The basic intuition for the price-raising effect of mergers can be gleaned from the two first-order conditions for a firm formed by merging the sellers of brands i and j:

$$m_i = 1/\varepsilon_i + m_j d_{ij} p_j / p_i$$

$$m_j = 1/\varepsilon_j + m_i d_{ji} p_i / p_j$$

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50. In *Heary Bros*., the court noted an objection to an expert's model on the grounds that it assumed that competitors compete by setting outputs, while the actual competitors did not literally do so. *Id.* at 1067. Such an objection should be overruled.

51. *Concord Boat*, 207 F.3d at 1056. "The model also failed to account for market events that both sides agreed were not related to any anticompetitive conduct . . . ." *Id.*

52. The latter name stems from the use of this condition by Abba P. Lerner, *The Concept and Measurement of Monopoly Power*, 1 REV. ECON. STUD. 157 (1934).

In these conditions, p_i and p_j are the prices of brands i and j, and d_{ij} and d_{ji} are the *diversion ratios* from brand i to brand j and from brand j to brand i.[53] That is, when the price of brand i is increased slightly, d_{ij} is the proportion of the decrease in the quantity of brand i purchased that is accounted for by the increase in quantity of brand j purchased. If brands i and j are substitutes, the second term in the equilibrium conditions is positive. Hence, the merger necessarily raises the prices of both brands unless it also reduces marginal costs, induces the entry of a new brand, or induces investments altering consumer perceptions about incumbent brands, which is termed "repositioning."[54]

The diversion ratios between merging brands increase as the brands become closer substitutes. This makes the second term in the equilibrium conditions larger, and other things being equal, causes the merger to produce larger price increases. However, the two diversion ratios between a pair of brands may be quite different. Highly asymmetric diversion ratios are likely for brands with very different shares because the amount of diversion to a brand tends to be closely related to its popularity as consumers' first choices. In addition, many consumers with brand i as their first choice may have brand j as their second choice even though few consumers with brand j as their first choice have brand i as their second choice.

Simple formulas indicate the magnitude of the price increases caused by the merger of two brands in a Bertrand model, provided that there is symmetry between the merging brands, so $m_i = m_j = m$ and $d_{ji} = d_{ij} = d$, and provided that demand takes either of two special forms.[55] If demand is "isoelastic," i.e., if all of the relevant demand elasticities are the same at every point on the demand curve, the proportionate increase in price from a merger is given by

$$md/(1 - m - d)$$

If demand is linear, the proportionate increase in price from a merger is given by

$$md/2(1 - d)$$

These formulas are of little value in predicting the effects of actual mergers, but they provide critical insights into the unilateral effects of mergers in Bertrand industries.

These formulas show that significant price increases can result from merging brands that are not exceptionally close substitutes or even the closest substitutes.[56] Suppose the diversion ratios between two merging brands are both one-third, and suppose both have premerger price-cost margins of .4. If demand is linear, the merger increases the prices of both merging brands by 10 percent. While diversions ratios of one-third make these

53. Diversion ratios were introduced by Shapiro, *supra* note 1.

54. For a more general demonstration that Bertrand mergers raise prices, see Raymond Deneckere & Carl Davidson, *Incentives to Form Coalitions with Bertrand Competition*, 16 RAND J. ECON. 473 (1985).

55. These results were derived by Shapiro, *supra* note 1, and assume that mergers neither affect costs nor induce entry or repositioning.

56. *See* MERGER GUIDELINES COMMENTARY, *supra* note 28, at 27-28 ("A merger may produce significant unilateral effects even though a large majority of the substitution away from each merging product goes to non-merging products. The products of the merging firms need only be sufficiently close to each other (that is, have sufficiently high diversion ratios) that recapturing the portion of the lost sales indicated by the diversion ratios provides a significant incentive to raise prices.").

brands close substitutes, each could have an even closer substitute with diversion ratios greater than one-third.

These formulas also show that the magnitudes of the price increases from the merger of competing brands depend not just on diversion ratios, but also on the "curvature" of demand. In the simple numerical example just presented, the prices of both brands increase 50 percent rather than 10 percent if demand is isoelastic rather than linear. The price increases are much greater with isoelastic demand than with linear demand because, with the latter but not the former, price increases cause demand to become more elastic, which makes further price increases less attractive.

The relationship between the curvature of demand and the price effects of Bertrand mergers has been explored systematically by comparing the predictions of the model with four commonly assumed demand forms—the linear and isoelastic demands just mentioned, as well as the logit and AIDS demand discussed below.[57] The price increases predicted with isoelastic and AIDS demand generally are at least several times those with linear and logit demand. More abstract mathematical analysis also shows that curvature properties of demand that cause greater price effects from mergers also cause marginal-cost reductions to be passed through to consumers at a higher rate.[58]

While the price and pass-through effects of mergers in Bertrand industries both depend on the curvature of demand, an important indicator of the unilateral effects of mergers in Bertrand industries does not. For a merger that induces neither the entry of a new brand nor repositioning of existing brands, the *compensating marginal cost reductions* (CMCRs), i.e., the marginal-cost reductions that exactly restore premerger prices, do not depend on demand curvature.[59] The CMCRs do not depend on the properties of demand because they restore the premerger prices and quantities, and hence all of the demand elasticities as well. With single-brand merging firms selling brands with identical demand and cost conditions, the CMCRs for both brands are

$$md/(1 - m)(1 - d),$$

if expressed as a proportion of premerger marginal cost. If, instead, the CMCRs are expressed as a proportion of premerger price, they are

$$md/(1 - d)$$

If $d = .5$, which makes the merging brands extraordinarily close substitutes, this last result implies the same rule of thumb as in a Cournot industry: To prevent postmerger price increases, the marginal costs of both the merging brands must fall by at least as much as the premerger prices exceed the premerger marginal costs. Merging brands

57. *See* Philip Crooke, Luke Froeb, Steven Tschantz & Gregory J. Werden, *The Effects of Assumed Demand Form on Simulated Post-Merger Equilibria*, 15 REV. INDUS. ORG. 205 (1999).

58. *See* Luke M. Froeb, Steven Tschantz & Gregory J. Werden, *Pass-Through Rates and the Price Effects of Mergers*, 23 INT'L J. INDUS. ORG. 793 (2005). For a less technical treatment of the same issues, see Gregory J. Werden, Luke M. Froeb & Steven Tschantz, *The Effects of Merger Efficiencies on Consumers of Differentiated Products*, 1 EUR. COMPETITION J. 245 (2005).

59. The CMCRs for the general case, as well as those for the special case that follows, are derived by Gregory J. Werden, *A Robust Test for Consumer Welfare Enhancing Mergers among Sellers of Differentiated Products*, 44 J. INDUS. ECON. 409 (1996).

typically are far less close substitutes, so much smaller cost reductions typically are sufficient to prevent price increases.

4.2. Unilateral effects analysis in the Oracle *decision*

The *Oracle* decision was the first by a court to provide an extensive discussion of unilateral effects, and that discussion addressed almost exclusively the analysis of unilateral effects with differentiated products.[60] The court correctly noted that market delineation is apt to be problematic with differentiated products and that market shares may not be good predictors of competitive effects.[61] The court also signaled receptivity to model-based economic analysis as an alternative for, or supplement to, traditional structural analysis. In particular, the court declared that "[m]erger simulation models may allow more precise estimations of likely competitive effects and eliminate the need to, or lessen the impact of, the arbitrariness inherent in defining the relevant market."[62] Merger simulation generates quantitative predictions of unilateral merger effects using one-shot oligopoly models with Nash, noncooperative equilibria, after first calibrating those models to match critical features of the industry, such as prices and demand elasticities.[63]

The dominant theme in the court's discussion of unilateral effects with differentiated products was that such effects are significant only when "the merging parties would enjoy a post-merger monopoly or dominant position, at least in a 'localized competition' space."[64] This theme first appears in the court's assertion that significant unilateral effects are possible only if substitutes for the merging brands are "sufficiently different."[65] This theme appears again in the court's declaration that a "presumption of

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60. United States v. Oracle Corp., 331 F. Supp. 2d 1098, 1113-23, 1166-73 (N.D. Cal. 2004). To whatever extent it is relevant, the author had some involvement in the case.

61. *Id.* at 1120-23. On the inherent difficulties in usefully delineating markets with differentiated consumer products, see Gregory J. Werden & George Rozanski, *The Application of Section 7 to Differentiated Products Industries: The Market Delineation Dilemma*, ANTITRUST, Summer 1994, at 40. For an evaluation of the utility of market shares as predictors of unilateral effects from mergers in Bertrand industries, see Gregory J. Werden & Luke M. Froeb, *Simulation as an Alternative to Structural Merger Policy in Differentiated Products Industries*, *in* THE ECONOMICS OF THE ANTITRUST PROCESS 65, 73-78 (Malcolm B. Coate & Andrew N. Kleit eds., 1996).

62. *Oracle*, 331 F. Supp. 2d at 1122.

63. For over a decade, economists have advocated and employed merger simulation in cases involving differentiated consumer products. *See, e.g.*, Jerry A. Hausman & Gregory K. Leonard, *Economic Analysis of Differentiated Products Mergers Using Real World Data*, 5 GEO. MASON L. REV. 321 (1997); Gregory J. Werden, *Merger Simulation: Potentials and Pitfalls*, *in* MODELLING EUROPEAN MERGERS 37 (Peter A.G. van Bergeijk & Erik Kloosterhuis eds., 2005); Gregory J. Werden & Luke M. Froeb, *Calibrated Economic Models Add Focus, Accuracy, and Persuasiveness to Merger Analysis*, *in* THE PROS AND CONS OF MERGER CONTROL 63, 70-78 (Swedish Competition Authority 2002); Gregory J. Werden, *Simulating the Effects of Differentiated Products Mergers: A Practical Alternative to Structural Merger Policy*, 5 GEO. MASON L. REV. 363 (1997).

64. *Oracle*, 331 F. Supp. 2d at 1118. The court confused matters by noting that the "localized competition space" to which it refers "may be much narrower than relevant markets defined in typical cases," *id.* at 1118, which suggested that the dominance requirement meant nothing more than that there must have been significant head-to-head competition between the merging brands.

65. *Id.* at 1117.

anticompetitive effects . . . is unwarranted" on the basis that the merging firms have "a combined share of 35%."[66] Most importantly, this theme appears in the court's holding that the evidence failed to establish that the merger would violate Section 7.

The court's analysis adopted the terminology of one of the defense experts. He argued that "'product space' is defined by characteristics of the products," and he used the word "node" to describe a narrow region of that space defined by particular product characteristics.[67] Using this terminology, the court asserted: "The unilateral effects theory is concerned about there being only one vendor operating inside the node, thereby being able to increase price unilaterally."[68] The court contended that this was the theory on which the government relied,[69] and it concluded that the evidence failed to demonstrate that merging firms operated alone in any such node.[70]

There is significant ambiguity in the court's discussion, particularly as a consequence of the way in which the court began the section of the decision titled "Findings of Fact: Unilateral Effects":

> The court finds that the plaintiffs have wholly failed to prove the fundamental aspect of a unilateral effects case—they have failed to show a "node" or an area of localized competition between Oracle and PeopleSoft. In other words, plaintiffs have failed to prove that there are a significant number of customers (the "node") who regard Oracle and PeopleSoft as their first and second choices."[71]

This passage uses the word "node" to relate to customer preferences, although the court had defined that word to relate to product characteristics. This passage also may be understood as a factual finding sufficient to decide the case under any unilateral effects theory.

The court's discussion suggested a spatial model of competition, in which brands with similar characteristics are close substitutes for each other, while brands with significantly different characteristics do not compete at all. Such a model may reflect consumer preferences in some cases,[72] but most often consumer preferences are best modeled as having a significant idiosyncratic component.[73] This component reflects the fact that brands matter to consumers, not just the physical attributes associated with

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66. *Id.* at 1123. As the court explained, the 1992 *Merger Guidelines* invoke a presumption of anticompetitive effects under certain circumstances if the combined share of the merging firms is at least 35%. 1992 MERGER GUIDELINES, *supra* note 22, § 2.211.

67. *Oracle*, 331 F. Supp. 2d at 1170-71. This terminology, particularly this use of the word "node," is highly unconventional in merger analysis.

68. *Id.* at 1170.

69. *Id.* at 1166 (asserting that the government's "theory of anticompetitive effects" was that the merging firms operated in "a 'localized' competition sphere (a 'node')" that did "not include . . . any other vendors").

70. *Id.* at 1166-69, 1172.

71. *Id.* at 1172.

72. For an analysis of brewer mergers in the United Kingdom using such a model, see Joris Pinkse & Margaret E. Slade, *Mergers, Brand Competition, and the Price of a Pint*, 48 EUR. ECON. REV. 617 (2004).

73. For an analysis of parking lot mergers using a spatial model incorporating an idiosyncratic component of consumer preferences, see Luke Froeb, Steven Tschantz & Philip Crooke, *Bertrand Competition with Capacity Constraints: Mergers Among Parking Lots*, 113 J. ECONOMETRICS 49 (2003).

brands, and consumers differ as to how brands matter and on the ranking of brands. When the price of one brand is increased, customers who cease purchasing it typically spread their purchases over many competing brands, including some with quite different physical attributes.[74]

It is also clear that significant unilateral effects are possible when the merging brands are not alone, or even nearly so, in the space of physical attributes. To see this, it suffices to consider the simple formulas presented in Section 4.1 that give the price increases from Bertrand mergers for certain special cases. As illustrated by the numerical example presented there, significant price increases occur even if the merging brands face significant competition. In that example, only a third of the substitution away from either merging brand goes to the other merging brand, yet the merger results in substantial price increases.

4.3. Choice models and logit demand

The demand for differentiated consumer products is often modeled by economists using a model of consumer choice in which each consumer maximizes utility in making a choice among an exhaustive set of alternatives.[75] The utility associated with alternative i is modeled as the sum of a component, V_i, common to all consumers and a customer-specific component treated as a random variable from the perspective of an outside observer. A convenient assumption as to the statistical distribution of the random component of utility leads to the logit model of demand.[76]

The simplest version of the logit model specifies that

$$V_i = \alpha_i - \beta p_i$$

In this formulation, p_i is the price of brand i, α_i is a constant that indicates brand i's average preference; and β is a constant that determines the degree of substitutability among brands.[77] If β is quite large, a merger has little effect on prices because

74. For example, substitution patterns of this sort have been observed for automobiles and breakfast cereals. *See* Steven T. Berry, James Levinsohn & Ariel Pakes, *Automobile Prices in Market Equilibrium*, 63 ECONOMETRICA 841, 880-81 (1995); Aviv Nevo, *Measuring Market Power in the Ready-to-Eat Cereal Industry*, 69 ECONOMETRICA 307, 331 (2001).

75. Such models were formalized by Charles Manski, *The Structure of Random Utility Models*, 8 THEORY & DECISION 229 (1977). For comprehensive treatments, see MOSHE BEN-AKIVA & STEVEN R. LERMAN, DISCRETE CHOICE ANALYSIS: THEORY AND APPLICATION TO TRAVEL DEMAND chs. 3 & 4 (1985); Daniel McFadden, *Econometric Models of Probabilistic Choice*, *in* STRUCTURAL ANALYSIS OF DISCRETE DATA WITH ECONOMETRIC APPLICATIONS 198 (Charles F. Manski & Daniel McFadden eds., 1981).

76. *See* SIMON P. ANDERSON, ANDRÉ DE PALMA & JACQUES-FRANÇOIS THISSE, DISCRETE CHOICE THEORY OF PRODUCT DIFFERENTIATION 39-40 (1992); Daniel McFadden, *Conditional Logit Analysis of Qualitative Choice Behavior*, *in* FRONTIERS IN ECONOMETRICS 105, 111-12 (Paul Zarembka ed., 1974).

77. For a simple presentation of the model in the context of merger analysis, see Gregory J. Werden & Luke M. Froeb, *The Antitrust Logit Model for Predicting Unilateral Competitive Effects*, 70 ANTITRUST L.J. 257 (2002). For a detailed presentation, see Gregory J. Werden, Luke M. Froeb & Timothy J. Tardiff, *The Use of the Logit Model in Applied Industrial Organization*, 3 INT'L J. ECON. BUS. 83 (1996). For an analysis of an actual proposed merger using this model, see Gregory J.

nonmerging brands are very close substitutes for the merging brands. If β is quite small, a merger has little effect on prices because there is essentially no price competition between the merging brands before the merger. With intermediate values of β, mergers can yield significant price effects.

This model illustrates that significant unilateral effects are possible even if the merged firm is not nearly as dominant, and the merging brands are not nearly as isolated from competing brands, as *Oracle* might be understood to require for a Section 7 violation. Consider the merger of any two brands in a six-brand market with all brands having the same price ($1) and sales before the merger. If the premerger demand elasticity at the market level is 0.5 and β is 2.9, the premerger price-cost margins in Bertrand equilibrium are .4, just as in the example in Section 4.1.[78] Although the merging brands are neither isolated from other brands nor dominant, and although the diversion ratios between the merging brands are half what the were in the example in Section 4.1, it can be shown that the merger causes the prices of the merging brands to increase by 5.7 percent.[79]

Mathematical analysis of this model also offers insights into the nature of the price effects of mergers. These insights are always valid with logit demand[80] and are often valid with other demands. First, a merger causes a larger increase in the price of the merging brand with the smaller share.[81] For any given loss in sales from an increase in the price of the merging brands, a larger portion is recaptured by the brand with the larger share, making it more profitable to increase the price of the lower share brand. The brand with the larger share also has the larger markup in the premerger equilibrium, making any given sales recapture more profitable, and also making it more profitable to increase the price of the lower share brand. Second, the prices of nonmerging brands increase in response to the increases in prices of merging brands, but prices of nonmerging brands increase much less than those of the merging brands.

The logit model exhibits independence of irrelevant alternatives (IIA), which means that substitution away from any brand as its price is increased is distributed among other brands in proportionate to their relative shares.[82] If the consumption of brand *i* is three times that of brand *j*, the IIA property implies that an increase in the price of any third brand induces three times as much substitution to brand *i* as to brand *j*.[83] The IIA

Werden, *Expert Report in* United States v. Interstate Bakeries Corp. and Continental Baking Co., 7 INT'L J. ECON. BUS. 139, 145-46 (2000).

78. Under these assumptions, 2.5 is the own-price elasticity of demand for each brand, and .4 is the cross-price elasticity of demand between every pair of brands.

79. The only additional assumption necessary for these calculations is that the marginal cost of each of the brands does not vary with the quantity produced.

80. *See* Gregory J. Werden & Luke M. Froeb, *The Effects of Mergers in Differentiated Products Industries: Logit Demand and Merger Policy*, 10 J.L., ECON. & ORG. 407 (1994).

81. What matters are the relative unit shares of the merging brands, so those shares need not be predicated on a delineated market.

82. The IIA property was introduced by a psychologist who termed it the "choice axiom" and found it consistent with some experimental evidence. *See* R. DUNCAN LUCE, INDIVIDUAL CHOICE BEHAVIOR: THEORETICAL ANALYSIS 5-6, 12-15 (1959).

83. The IIA property is restrictive, and for some choice problems, it is unreasonably so. *See* Gerard Debreu, *Review of* Individual Choice Behavior: A Theoretical Analysis *by R. Duncan Luce*, 50 AM.

property provides a useful definition of what it means for a set of brands all to be equally close substitutes for each other. The assumption of equally close substitutes is reasonable absent contrary evidence, but there are many situations in which it is important to model demand in a manner allowing the merging brands to be especially close, or especially distant, substitutes.

The academic literature has employed several variations of the simple logit model that incorporate brand characteristics in various ways.[84] In the nested logit model,[85] brands are grouped on the basis of shared attributes, and whether grouped brands are especially close substitutes is determined empirically. Several published quantitative analyses of mergers employ nested logit models.[86] The most popular approach in the academic literature today treats the coefficients in the V_i function as random variables, resulting in a mixed-logit model,[87] and several published quantitative analyses of mergers employ such models.[88] Mixed-logit models have potentially significant advantages because of the flexible way they incorporate consumer heterogeneity, but they are difficult to estimate.

4.4. Flexible functional forms

Many quantitative analyses of proposed mergers in Bertrand industries use flexible functions forms designed to approximate an unknown true demand function.[89] In principle, flexible functional forms do not constrain any of the own-price or cross-price elasticities of demand for the brands of interest. A popular flexible functional form for

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ECON. REV. 186 (1960). For example, the IIA property may be unreasonably restrictive if it is applied to choice among all automobiles, although not if it is applied only to choice among just economy cars.

84. A model adding brand characteristics to the V_i function was used to analyze hypothetical mergers of Japanese long-distance carriers by Luke M. Froeb, Timothy J. Tardiff & Gregory J. Werden, *The Demsetz Postulate and the Welfare Effects of Mergers in Differentiated Products*, *in* ECONOMIC INPUTS, LEGAL OUTPUTS: THE ROLE OF ECONOMISTS IN MODERN ANTITRUST 141 (Fred S. McChesney ed., 1996).

85. *See generally* ANDERSON ET AL., *supra* note 76, at 46-48; Daniel McFadden, *Modelling the Choice of Residential Location*, *in* SPATIAL INTERACTION THEORY AND PLANNING MODELS 75 (Anders Karquist et al. eds., 1978).

86. Roger Feldman, *The Welfare Economics of a Health Plan Merger*, 6 J. REG. ECON. 67 (1994); Marc Ivaldi & Frank Verboven, *Quantifying the Effects from Horizontal Mergers in European Competition Policy*, 23 INT'L J. INDUS. ORG. 669 (2005) (proposed Volvo-Scania merger involving heavy trucks); Werden & Froeb, *supra* note 80, at 417-20 (hypothetical mergers of U.S. long-distance carriers).

87. *See, e.g.*, Berry et al., *supra* note 74; Steven T. Berry, James Levinsohn & Ariel Pakes, *Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Car Market*, 112 J. POL. ECON. 68 (2004); Daniel McFadden & Kenneth Train, *Mixed MNL Models for Discrete Response*, 89 J. APPLIED ECONOMETRICS 109 (1999); Aviv Nevo, *A Practitioner's Guide to Estimation of Random-Coefficients Logit Models of Demand*, 9 J. ECON. & MGMT. STRATEGY 513 (2002); Amil Petrin, *Quantifying the Benefits of New Products: The Case of the Minivan*, 110 J. POL. ECON. 705 (2002).

88. Martin Gaynor & William B. Vogt, *Competition among Hospitals*, 34 RAND J. ECON. 764 (2003); Aviv Nevo, *Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry*, 31 RAND J. ECON. 395 (2000).

89. *See generally* ROBERT A. POLLAK & TERENCE J. WALES, DEMAND SYSTEM SPECIFICATION AND ESTIMATION 60-67 (1992).

estimating consumer demand is the almost ideal demand system (AIDS) model,[90] and several published quantitative analyses of mergers employ that model.[91] The flexibility of flexible functional forms, however, does not extend to the curvature properties critical in determining the price effects of mergers, and AIDS models are apt to predict postmerger price increases several times those from logit or linear demand models.[92]

Commonly, brands are so numerous that reliably estimating all of the relevant demand elasticities is impossible with the available data. Consequently, considerable structure must be imposed on demand, even when a flexible functional form is employed. In estimating an AIDS model, multistage budgeting is assumed,[93] breaking the consumer choice problem into series of decisions, and leaving a relatively narrow range of brands to be included in the AIDS model. This imposes highly restrictive substitution patterns on pairs of brands unless both are included in the AIDS model itself. Even more restrictions on substitution patterns are imposed by the proportionately calibrated AIDS (PCAIDS) model, which assumes AIDS demand but calibrates the demand elasticities by assuming the IIA property holds premerger (making the premerger demand elasticities the same as those in the logit model). Versions of this model have been used in published quantitative analyses of mergers.[94]

4.5. Entry and repositioning

The foregoing has assumed that a merger would induce neither entry of new brands nor repositioning of existing brands. The 1992 *Merger Guidelines*, however, properly state that either entry or repositioning could prevent any anticompetitive effects from a differentiated products merger.[95] Moreover, the *Oracle* decision places on the plaintiff

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90. *See* Angus Deaton & John Muellbauer, *An Almost Ideal Demand System*, 70 AM. ECON. REV. 312 (1980).

91. The use of the AIDS model in merger analysis was pioneered by Jerry Hausman, Gregory Leonard & J. Douglas Zona, *Competitive Analysis with Differenciated Products*, 34 ANNALES D'ECONOMIE ET STATISTIQUE 159 (1994) (hypothetical mergers of North American brewers); Hausman & Leonard, *supra* note 63 (merger of U.S. producers of bathroom tissue). For applications to merger analysis of both the AIDS model and another flexible functional form, see Andrew Abere, Oral Capps, Jr., Jeffery Church & H. Alan Love, *Mergers and Market Power: Estimating the Effect on Market Power of the Proposed Acquisition of The Coca-Cola Company of Cadbury Schwepps' Carbonated Soft Drinks in Canada*, *in* MEASURING MARKET POWER 233 (Daniel J. Slottje ed., 2002); Oral Capps, Jr., Jeffrey Church & H. Alan Love, *Specification Issues and Confidence Intervals in Unilateral Price Effects Analysis*, 113 J. ECONOMETRICS 3 (2003) (hypothetical mergers of U.S. spaghetti sauce producers).

92. *See* Crooke et al., *supra* note 57.

93. *See* W.M. Gorman, *Two-Stage Budgeting*, *in* 1 SEPARABILITY AND AGGREGATION: COLLECTED WORKS OF W.M. GORMAN 22 (C. Blackorby & A.F. Shorrocks eds., 1995).

94. Roy J. Epstein & Daniel L. Rubinfeld, *Merger Simulation with Brand-Level Margin Data: Extending PCAIDS with Nests*, 4 ADVANCES ECON. ANALYSIS & POL. (2004), *available at* www.bepress.com/bejeap/advances/vol4/iss1/art2 (hypothetical mergers of North American brewers); Roy J. Epstein & Daniel L. Rubinfeld, *Merger Simulation: A Simplified Approach with New Applications*, 69 ANTITRUST L.J. 833 (2002) (mergers involving bathroom tissue and baby food).

95. 1992 MERGER GUIDELINES, *supra* note 22, § 2.212 ("A merger is not likely to lead to unilateral elevation of prices of differentiated products if, in response to such an effect, rival sellers likely would replace any localized competition lost through the merger by repositioning their product lines."), § 3.0 ("A merger is not likely to create or enhance market power or to facilitate its exercise, if entry into the

the burden of "demonstrat[ing] that the nonmerging firms are unlikely to introduce products sufficiently similar to the products controlled by the merging firms to eliminate any significant market power created by the merger."[96]

Economic research has begun to examine the incentive for entry following the merger of two brands in a differentiated products industry. This research suggests that most mergers are unlikely to induce entry because they have little effect on the profitability of nonmerging brands.[97] The high incidence of new product failure, which is not accounted for in this research, makes a merger even less likely to induce the entry of a new brand.[98]

Economic research also has begun to examine the incentive for product repositioning following a merger. This research posits a simple model in which competitors are arrayed along a line and are able to alter their locations as freely as their prices.[99] In this model, a merger does not create an incentive to reposition nonmerging brands closer to the merging brands; rather, the merger creates an incentive to reposition the merging brands away from each other. This repositioning mitigates the price-increasing effects of the merger as suggested by the 1992 *Merger Guidelines*, but it does so in a manner quite different than they describe. It must be emphasized that this research ignores the critical fact that altering a brand's physical characteristics is risky, as the New Coke saga dramatically illustrates. Moreover, a brand's physical characteristics may not be nearly as important as consumer perceptions, which may cost much more, and take far longer, to alter.

4.6. When does the Bertrand model "fit" an industry?

The key test for the fit of an economic model in a merger case is its ability explain for the recent past what it is expected to predict for the near future. To the extent that price increases for the merging brands are the focus of the unilateral effects analysis, an oligopoly model fits the industry only if it explains reasonably well the general level of prices for the merging brands before the merger. Because the model is not being relied upon to predict week-to-week price movements or special promotions, it is wholly unnecessary that it explain such things.

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market is so easy that market participants, after the merger, either collectively or unilaterally could not profitably maintain a price increase above premerger levels.").

96. United States v. Oracle Corp., 331 F. Supp. 2d 1098, 1118 (N.D. Cal. 2004). Placing this burden on the plaintiff arguably departs from Supreme Court precedent. *See supra* note 15 and accompanying text.

97. *See* Werden & Froeb, *supra* note 43, which assumes logit demand.

98. Failure examples are legion, even for products carrying established brand names and backed by substantial marketing expenditures. *See generally* ROBERT M. MCMATH, WHAT WERE THEY THINKING? (1998); *Flops*, BUSINESS WEEK, August 16, 1993, at 76. High failure rates have been reliably reported. *See* Abbie Griffin, *PDMA Research on New Product Development Practices: Updating and Benchmarking Best Practices*, 14 J. PROD. INNOVATION MGMT. 429, 431-34 (1997) (finding a failure rate of 41% and reporting earlier findings of 33-47%).

99. Amit Gandhi, Luke M. Froeb, Steven Tschantz & Gregory J. Werden, *Post-Merger Product Repositioning*, 56 J. INDUS. ECON. 49 (2008) (analyzing a spatial model of competition with idiosyncratic consumer tastes).

The most useful indicator of how well the Bertrand model explains average prices is how well it explains price-cost margins. The first-order conditions for Bertrand equilibrium in Section 4.1 relate the price-cost margins of individual brands to their demand elasticities. These elasticities can be estimated econometrically, and the margins implied by estimated demand elasticities can be compared to margins derived from accounting data.[100] Accounting data from the merging firms often provide a reasonable indication of the price-cost margins for their brands, and it is important that the model explain those margins reasonably well. Cost data for nonmerging brands typically is unavailable, but it is not critical that the model explain those margins, and it is neither unusual nor worrisome that some minor brands are not priced as the model predicts.

The Bertrand model may fit a wide variety of industries in which products are differentiated in important ways, particularly consumer goods industries in which brands are important.[101] The model may fit an industry quite well enough even though it does not fully reflect all of the industry's institutional detail. Price is the only dimension of competition in the Bertrand model. That is not true in most real world differentiated products industries, but price still may be the principal dimension of competition affected by a merger over the relatively near term on which Section 7 of the Clayton Act focuses. Although competitors can change marketing strategies and the characteristics of their products, it may be reasonable to suppose that the proposed merger would not induce such reactions. Of course, the import of nonprice competition must be evaluated on the basis of the facts of each particular case.

The Bertrand model may not fit an industry in which merging manufacturers of differentiated consumer products do not sell directly to consumers. The version of the Bertrand model considered here assumes direct sales, but an intervening retail sector presents no difficulties if retailers apply a constant percentage markup to the prices paid to manufacturers.[102] In that event, the relevant demand elasticities at the retail level are exactly the same as those at the manufacturing level, so ignoring the retail sector is an unimportant simplification. In other cases, the relationship between retailers and manufacturers can have important implications for the effects of manufacturer mergers on consumers, so that relationship must be considered in evaluating the fit of the Bertrand model. There is only sparse economic literature on the impact of retailer-manufacturer relationships, and it has addressed only the case of monopoly retailers.[103] This literature, however, suggests that the merger of the manufacturers can have no

100. Several published quantitative analyses of mergers have tested the fit of the Bertrand model by comparing predicted and actual price-cost margins for all brands. Pinske & Slade, *supra* note 72, conducted a formal statistical test for the average margin, based on detailed price and cost data. The Bertrand assumption made by Nevo, *supra* note 88, was supported by a similar test performed by Nevo, *supra* note 74.

101. For eight examples of mergers to which the federal enforcement agencies applied the Bertrand model, see MERGER GUIDELINES COMMENTARY, *supra* note 28, at 27-31.

102. Werden, *supra* note 77, found clear evidence that this was their practice in one particular case.

103. *See* Luke M. Froeb, Steven Tschantz & Gregory J. Werden, *Vertical Restraints and the Effects of Upstream Horizontal Mergers*, *in* THE POLITICAL ECONOMY OF ANTITRUST 369 (Vivek Ghosal & Johan Stennek eds., 2007); Daniel P. O'Brien & Greg Shaffer, *Bargaining, Bundling, and Clout: The Portfolio Effects of Horizontal Mergers*, 36 RAND J. ECON. 573 (2005).

effect on retail prices, and it can have the same effect as if the manufacturers sold directly to consumers.

If manufacturers and retailers use two-part contracts, with both unit prices and fixed fees, retail prices are unaffected by the merger if the retailer is entirely free to choose which brands to carry and therefore can credibly threaten to deal exclusively with one manufacturer.[104] If the retailer carries both merging brands in the premerger equilibrium, the merger increases the merging manufacturers' share of total profits but has no effect on wholesale unit prices or retail prices because the same retail prices maximize total profits before and after the merger.[105] Things are quite different with restrictions on the retailer's ability to refuse to carry particular brands. The premerger equilibrium features wholesale unit prices inducing the retail prices the manufacturers would set if they sold directly to consumers, along with fixed fees that transfer all profits to the manufacturers. The merger has the same effects on retail prices as if the manufacturers sold directly to consumers.

104. Without the use of fixed fees, competition among manufacturers determines the degree to which they price above their marginal costs, and the retailer acts as a monopolist facing the wholesale prices as its brand-specific marginal costs. The effect of a manufacturer merger is to raise the retailer's marginal costs, and the effect on retail prices is determined by the curvature properties of retail demand, just as it is for the pass-through of marginal-cost reductions.

105. The analysis of this case is that described in the economic literature on vertical restraints. *See* B. Douglas Bernheim & Michael D. Whinston, *Exclusive Dealing*, 106 J. POL. ECON. 64 (1998); Daniel P. O'Brien & Greg Shaffer, *Nonlinear Supply Contracts, Exclusive Dealing, and Equilibrium Market Foreclosure*, 6 J. ECON. & MGMT. STRATEGY 755 (1997).