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I. INTRODUCTION

The competitive analysis of horizontal mergers in the United States follows a well-established and widely accepted economic framework.[1] A merger allows previously independent competitors to coordinate their price and output decisions to maximize joint profits. To the extent that the merging firms otherwise would compete with each other and are not sufficiently constrained by competition from other rivals, the combined firm has an incentive to raise prices and thereby reduce competition. This concern that prices may rise may be mitigated, for example, if rival firms are intensely competitive with the merged firm, if entry or expansion by small rivals in response to a price increase is easy, or if the merger significantly reduces costs or leads to superior products.

Similarly, the competitive analysis of horizontal price fixing is also well established. If two or more competing firms coordinate their price or output decisions, and there are no cost savings or other benefits from the integration, then prices can rise and competition can be harmed.

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[1] *See* U.S. Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines (1992), *reprinted in* 4 Trade Reg. Rep. (CCH) ¶ 13,104.

Although the legal treatment of mergers and price fixing differs, the competitive analysis is motivated by the same basic economic principles.

Nevertheless, the competitive analysis of partial ownership interests is less well established. A partial ownership interest could have competitive effects when one or more competing firms purchase some percentage of a rival firm's stock, or when two or more firms jointly invest in a venture that competes in the same market. Should these transactions be viewed as complete mergers? That seems wrong if the firms' managers retain some independence. Should they be viewed as naked price fixing? That seems overly simplistic because joint ventures and partial ownership stakes can create efficiency benefits. Should they be viewed as competitively innocuous? That seems wrong because partial ownership can affect the incentives of the owners.

Treatment of partial ownership interests is an important issue for antitrust and regulatory policy. Partial ownership interests and joint ventures are common and have become more important in telecommunications and high technology industries. For example, in the Time Warner/Turner case before the FTC in 1996, the acquired firm, Turner Broadcasting, controlled several cable program services (e.g., CNN, TNT, Cartoon Network) and was owned by several cable companies, many of which had ownership interests in competing program services. The acquiring firm, Time Warner, owned several program services (e.g., HBO/Cinemax) that competed for viewers and cable channel slots with the services owned by Turner and the cable operators. TCI, the largest cable operator, one of Turner's larger shareholders, and an owner of significant programming interests, was to receive a 9 percent share of Time Warner as part of the transaction.[2] The FTC cleared the deal with a consent decree intended to prevent TCI Chairman John Malone from influencing Time Warner's decisions.[3]

Similar issues arose in the Department of Justice's investigation of Primestar's proposed acquisition of the Direct Broadcast Satellite slot

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[2] This brief description does not begin to do justice to the issues surrounding the complex array of partial ownership interests that were important in this transaction. *See* Stan Besen et al., *Vertical and Horizontal Ownership in Cable TV: Time Warner-Turner* (1996), *in* THE ANTITRUST REVOLUTION: ECONOMICS, COMPETITION, AND POLICY 452–75 (John E. Kwoka, Jr. & Lawrence J. White eds., 3d ed. 1999).

[3] Time Warner Inc., 61 Fed. Reg. 5,0301 (Sept. 25, 1996). The pending acquisition of MediaOne by AT&T raises these same issues. By its acquisition of TCI, AT&T now owns a part of Time Warner Entertainment. MediaOne also owns a share of Time Warner Entertainment. Thus, the merger would increase AT&T's share of Time Warner's cable systems and programming.

owned by News Corporation and MCI,[4] the Questar proposed acquisition of an interest in the Kern River Pipeline, the General Motors-Toyota joint venture, and many other transactions.[5] Similarly, the DOJ has challenged a very recent deal in which Northwest Airlines purchased a 15 percent financial interest and 51 percent of the voting interest in Continental Airlines, one of its competitors.[6] The competitive effect of partial ownership also is an issue for the Federal Communications Commission, the Federal Reserve Board, and the Federal Energy Regulatory Commission.[7] Most recently, the FTC and DOJ have issued draft guidelines on competitor collaborations, which include a brief discussion of the financial interest and corporate control issues discussed in this article.[8]

In this article, we set up an economic framework for analyzing the competitive effects of partial ownership interests. We have three main

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[4] Primestar is a satellite television service owned by cable operators that competes with the cable operators, with other Direct Broadcast Satellite providers like DirecTV and Dish, and potentially with the new satellite service that was expected to be offered over the News Corporation/MCI satellite slot. The Department of Justice's anticompetitive theory was that Primestar would compete less aggressively with cable than would an independent owner of the new satellite slot. Complaint, United States v. Primestar, Inc., No. 1:98CV01193 (JLG) (D.D.C. May 12, 1998).

[5] For other investigated transactions involving partial ownership acquisitions, *see infra* note 22. Charles River Associates consulted with Primestar and Kern River Pipeline in those matters. Steven C. Salop consulted with Kern River in the Questar transaction and with Chrysler in connection with the General Motors-Toyota joint venture. For analysis of the General Motors-Toyota joint venture, see Timothy F. Bresnahan & Stephen C. Salop, *Quantifying the Competitive Effects of Production Joint Ventures*, 4 INT'L J. INDUS. ORG. 155 (June 1986); Janusz Ordover & Carl Shapiro, *The General Motors-Toyota Joint Venture: An Economic Assessment*, 31 WAYNE L. REV. 1167 (1985); John E. Kwoka, Jr., *International Joint Venture: General Motors and Toyota*, *in* THE ANTITRUST REVOLUTION 46 (John E. Kwoka, Jr. & Lawrence J. White eds., 1989).

[6] This transaction was still in litigation with the Department of Justice at the time of publication. An important issue, according to the complaint, is the extent to which a ten-year voting trust might insulate Continental's managers from influence by Northwest. Amended Complaint, United States v. Northwest Airlines Corp., No. 98-74611 (E.D. Mich. Dec. 18, 1998) <http://www.usdoj.gov>.

[7] The FCC has long enforced rules governing cross-ownership within and among various media. For example, the rules governing Horizontal Ownership Limits in cable prevent any firm from having an "attributable interest" in more than 35% of the cable operators nationwide. An "attributable interest" is defined in the FCC's Attribution Rules as one in which the financial interest exceeds 5%. *See In re:* Implementation of Section 11(c) of the Cable Television Consumer Protection and Competition Act of 1992: Horizontal Ownership Limits, MM Docket No. 92-264 (F.C.C. June 26, 1998). Other regulatory agencies enforce similar rules. For example, the Bank Holding Company Act requires prior approval for any Bank Holding Company to acquire 5% or more of any bank. 12 U.S.C. §§ 1841–1859 (1994 & Supp. III 1997). Similarly, under the Public Utilities Regulatory Act of 1978, the Federal Energy Regulatory Commission certifies small power production and co-generation facilities only if no more than 50% of the equity interest in the facility is held by electric utilities or electric utility holding companies. 16 U.S.C. §§ 2601–2645 (1994).

[8] Federal Trade Commission & U.S. Department of Justice, Draft Antitrust Guidelines for Collaborations Among Competitors § 3.34 (Oct. 1, 1999) <http://www.ftc.gov> [hereinafter

goals. First, we conceptually derive and explain the competitive effects of partial ownership, explaining its key elements and drawing analogies to the key ideas behind the analysis of horizontal mergers. Second, we present a general framework for evaluating the competitive effects of partial ownership that is analogous to, but at the same time recognizes key differences in the standard analysis for evaluating horizontal mergers. Third, we examine several methods of quantifying these competitive effects.

Intuition might suggest that partial ownership is less competitively problematical than a full merger because the parties can continue to compete with one another after the transaction. Indeed, in their treatise, Phillip Areeda and Donald Turner conclude that a "noncontrolling acquisition has no intrinsic threat to competition at all."[9]

However, this intuition is not always correct. We find that partial investments can raise either larger or smaller concerns than complete mergers. This may seem surprising, since a partial acquisition would appear to align the parties' interests less in all cases than would a complete merger.

The competitive effects of partial ownership depend critically on two separate and distinct elements: financial interest and corporate control.[10] This distinction is absent in merger analysis, which assumes that the acquiring firm (or person) automatically controls the acquired entity after the merger. With partial ownership interests, however, these elements are separable. They also can occur in ways that result in greater or lower harm to competition than a complete merger.

One of the key issues in this area is whether the methodology and quantitative measures used in the Horizontal Merger Guidelines can be applied to partial ownership interests and joint ventures, or alternatively, whether other quantitative methods can be devised. In their treatise, Areeda and Turner argue that such a quantification is impossible. As they conclude,

> Unfortunately, there is no formula that can describe the likelihood of such effects. . . . Inappropriate, for example, would be a formula that

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Competitor Collaboration Guidelines]. See also the seminal article by Joseph F. Bradley, *Joint Ventures and Antitrust Policy*, 95 HARV. L. REV. 1521 (1982).

[9] 5 PHILLIP AREEDA & DONALD F. TURNER, ANTITRUST LAW ¶ 1203d, at 322 (1980).

[10] That framework for analyzing the competitive effects of financial interest and corporate control was developed by Robert J. Reynolds & Bruce R. Snapp, *The Competitive Effects of Partial Equity Interests and Joint Ventures*, 4 INT'L J. INDUS. ORG. 141–53 (June 1986), and Bresnahan & Salop, *supra* note 5. *See also* William Nye, *Can a Joint Venture Lessen Competition More than a Merger?*, 40 ECON. LETTERS 487–89 (1992).

> attempted to discount market shares . . . according to the acquirer's shareholding. . . . [T]here is no reason to suppose that the effects of lesser acquisitions are in any way proportional to shareholdings.[11]

This view has been challenged in the economics literature. In an earlier article, Timothy F. Bresnahan and Steven C. Salop developed modifications to the standard Herfindahl-Hirschman Index (HHI) for analysis of some types of partial ownership acquisitions.[12] The increase in the HHI from a transaction is proportional to the market shares of the firms. This article extends the "modified" HHI to a richer set of corporate control scenarios and multiple, overlapping ventures. We also explain Carl Shapiro's diversion ratio approach and modify it slightly by defining the Price Pressure Index (PPI) to quantify the competitive effects of partial ownership interests and horizontal joint ventures.[13] Importantly, the PPI provides a framework for evaluating partial stock acquisitions in markets involving differentiated products.

We also show how partial ownership relates quantitatively to full mergers. Indeed, in our framework, a full merger is a special case of a "partial" investment of 100 percent that gives the acquiring firm complete control. Partial ownership forces the analyst to grapple with the question of the degree of control or influence that partial owners have over managers, how partial ownership translates into control or influence, and how this influence translates into competitive effects. Thus, unlike most merger analysis, a central part of the analysis of partial ownership is an assessment of which owners have what type of control over the corporation and how this control translates into management decisions.

This distinction between financial interest and corporate control clearly is not a new idea. Its implications for stockholder value and corporate law were analyzed over sixty years ago by Berle and Means in

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[11] 5 AREEDA & TURNER, *supra* note 9, at 322 & n.18.

[12] Bresnahan & Salop, *supra* note 5.

[13] The diversion ratio approach is described in Carl Shapiro, *Mergers with Differentiated Products*, ANTITRUST, Spring 1996, at 23. The diversion ratio measures the amount of a firm's sales that are diverted to the firm's merger partner in response to a price increase, relative to the total substitution away from the firm. As a technical economic matter, the diversion ratio is the ratio of the cross-elasticity of demand to the own elasticity of demand, multiplied by the ratio of the quantity of the firm to that of its merger partner. *See also* Gregory J. Werden, *Demand Elasticities in Antitrust Analysis*, 66 ANTITRUST L.J. 363 (1998); Jonathan B. Baker, *Product Differentiation Through Space and Time: Some Antitrust Policy Issues*, 4 ANTITRUST BULL. 177–96 (1997); 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 (Malcolm B. Coate & Andrew M. Kleit eds., 1996); Robert Willig et al., *Merger Analysis, Industrial Organization Theory, and Merger Guidelines*, BROOKINGS PAPERS ON ECONOMIC ACTIVITY: MICROECONOMICS 281 (1991). As explained in more detail *infra* Part V, the PPI is a measure for quantifying and scaling the impact of a merger or partial ownership acquisition on a firm's unilateral pricing incentives.

their path-breaking work.[14] However, Berle and Means focused on the implications of the separation of ownership and control on the performance of the individual corporation. In this article, we examine its implications for the competitive performance of the markets in which firms may have partial ownership interests in their rivals.

This article is organized as follows. In Part II, we provide a brief overview of the basic legal standards, which do not provide an adequate framework for analysis of partial stock acquisitions. In Part III, we set out the basic economic framework for analyzing partial ownership interests. We draw the distinction between the financial interest and corporate control arising from a partial ownership interest. We also examine how these two factors affect the competitiveness of the unilateral pricing incentives of the acquiring firm and the firm in which it acquires a partial ownership interest. In this discussion, we define and analyze a variety of different corporate control assumptions, such as silent financial interest, total control, and Coasian joint control. In Part IV, we extend this framework and analysis to joint ventures, distinguishing between horizontal and vertically integrated joint ventures. In Part V, we develop methods for quantifying the effect of partial ownership interests and joint ventures on the competitive incentives of the interested firms. Finally, an Appendix sets out the more technical economic analysis of partial ownership acquisitions.

We believe that the framework and analysis in this article is very timely. The recent draft Guidelines for Collaborations Among Competitors draw the distinction between financial interest and control.[15] However, they do not explore the various structures examined here. Nor do they attempt to quantify the effects of alternative governance structures on competition.

II. BASIC LEGAL FRAMEWORK

This Part presents a brief overview of the basic legal framework for antitrust evaluation of partial ownership acquisitions. In general, the relevant statutory language, case law, and consent orders provide only limited guidance in assessing the antitrust risk associated with partial stock acquisitions. For this reason, the basic economic framework for evaluating the competitive effects of partial stock acquisitions becomes especially important.

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[14] *See* ADOLF A. BERLE, JR. & GARDINER C. MEANS, THE MODERN CORPORATION AND PRIVATE PROPERTY (1932).

[15] Competitor Collaboration Guidelines, *supra* note 8, §§ 3.34(b) & 3.34(c).

Acquisitions of voting securities may be challenged under Section 1 of the Sherman Act, which prohibits contracts, combinations, or conspiracies in restraint of trade.[16] Unlike Section 7 of the Clayton Act, Section 1 is not an incipiency statute prohibiting likely or probable conduct in the future. Accordingly, a plaintiff challenging an acquisition under Section 1 carries the burden of proving an actual anticompetitive effect through a restraint of trade, as well as concerted action.[17] While plaintiffs often include Section 1 claims in their complaints, there appears to be only one reported decision focusing on a Section 1 claim directed at partial acquisition of stock.[18]

Partial ownership interests have been examined more often in the context of Section 7 of the Clayton Act and the Hart-Scott-Rodino Act. Section 7 of the Clayton Act covers the acquisition of "any part" of the stock of another company.[19] The statute does not require acquisition of stock sufficient to confer control; nor does it contain a threshold or a minimum stock purchase amount. It simply requires acquisition of "any part" of a company's stock where the effect may be substantially to lessen competition.[20] For example, acquisitions of less than 25 percent of a company's stock have been found to violate Section 7.[21] In enforcing the Clayton Act more recently, the Department of Justice and the FTC have brought complaints and entered into consent orders limiting partial stock acquisitions. Several of the cases involved partial stock acquisitions of less than 30 percent.[22]

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[16] 15 U.S.C. § 1; *see also* United States v. First Nat'l Bank & Trust, 376 U.S. 665, 671–72 (1964) ("Where, as here, merging companies are major competitive factors in a relevant market, the elimination of significant competition between them, by merger or consolidation, itself constitutes a violation of § 1 of the Sherman Act.").

[17] Texas Gulf, Inc. v. Canada Dev. Corp., 366 F. Supp. 374, 406–07 & n.49 (S.D. Tex. 1973) (rejecting § 1 claim, based on lack of present anticompetitive effect, in preliminary injunction action brought by target of tender offer for 35% of its stock).

[18] *Id.*

[19] 15 U.S.C. § 18.

[20] *Id.; see also* Denver & Rio Grande W. R.R. Co. v. United States, 387 U.S. 485, 501 (1967).

[21] United States v. E.I. du Pont de Nemours & Co., 353 U.S. 586, 602–07 (19961) (23% stock acquisition violates § 7); *Denver & Rio Grande,* 387 U.S. at 501–04 (20% stock acquisition warrants ICC assessment of anticompetitive effects under § 7); American Crystal Sugar Co. v. Cuban-American Sugar Co., 259 F.2d 524, 526, 531 (2d Cir. 1958) (23% stock acquisition violates § 7); Crane Co. v. Harsco Corp., 509 F. Supp. 115, 123–25 (D. Del. 1981) (20% stock acquisition analyzed under § 7 for horizontal and vertical effects); United Nuclear Corp. v. Combustion Eng'g, Inc., 302 F. Supp. 539, 540, 552–55 (E.D. Pa. 1969) (21% stock acquisition violates § 7); Hamilton Watch Co. v. Benrus Watch Co., 114 F. Supp. 307, 313, 317 (D. Conn.) (24% stock acquisition violates § 7), *aff'd,* 206 F.2d 738 (2d Cir. 1953).

[22] United States v. Gillette Co., Proposed Final Judgment, Stipulation, and Competitive Impact Statement, 55 Fed. Reg. 12,567, 12,569 (1990) (imposing restrictions to sterilize acquisition of 23% non-voting shares); Medtronic, Inc., Analysis to Aid Public Comment,

According to the statutory language, Section 7 of the Clayton Act "shall not apply to persons purchasing such stock [1] solely for investment and [2] not using the same by voting or otherwise to bring about, or in attempting to bring about, the substantial lessening of competition."[23] The courts have read this solely-for-investment exemption in two parts. First, the defendant must show that it made the stock acquisition solely for "investment," a term not defined in the statute. Second, if that showing has been made, the plaintiff then carries the burden of establishing that the stock *is* being used to bring about or attempt to bring about a substantial lessening of competition.[24]

As a matter of statutory construction, the exemption from Section 7 turns largely on interpretation of an undefined, ambiguous term—"investment." With this limited statutory guidance, the courts have struggled to evaluate partial stock acquisitions and have not set forth any clear guidelines or parameters.

Perhaps one could look for guidance in the HSR Act, which exempts from reporting requirements acquisitions solely for purposes of investment, when the securities acquired or held do not exceed 10 percent of the outstanding voting securities of the issuer.[25] This is a notification provision and does not bear directly on substantive antitrust analysis.[26] Nevertheless, the HSR statutory exemption arguably speaks to the substantive antitrust analysis, and possibly reflects the judgment of Congress

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63 Fed. Reg. 53,919, 53,920 (1998) (restrictions imposed to make passive 10% holding of voting stock); United States v. Rockwell Int'l Corp., Proposed Final Judgment, Stipulation, and Competitive Impact Statement, 45 Fed. Reg. 69,314 (1980) (full divestiture of 29% stock holding); United States v. AT&T Corp., Proposed Final Judgment, Stipulation, and Competitive Impact Statement, 64 Fed. Reg. 2506 (1999) (full divestiture of 23.5% stock holding); United States v. MCI Communications. Corp., Proposed Final Judgment, Stipulation, and Competitive Impact Statement, 59 Fed. Reg. 33,009 (1994) (restrictions imposed on 20% stock holding); Time Warner, Inc., Proposed Consent Agreement with Analysis to Aid Public Comment, 61 Fed. Reg. 50,301, 50,308 (1996) (requiring divestiture of 7.5% equity position or acceptance of capped non-voting shares); Shell Oil Co., Analysis to Aid Public Comment, 62 Fed. Reg. 67,868, 67,871 (1997) (full divestiture of either a 14% interest or a separate 24% stock interest); U.S. Dep't of Justice Press Release, American Airlines Cleared to Acquire Stock in Argentine Airline (July 8, 1998) (restructuring to create an 8.5% passive investor).

[23] 15 U.S.C. § 18.

[24] *See* United States v. Tracinda Inv. Corp., 477 F. Supp. 1093, 1098 (C.D. Cal. 1979); Anaconda Co. v. Crane Co., 411 F. Supp. 1210, 1219 (S.D.N.Y. 1975). The courts have observed that the present-tense language of the exemption ("to bring about") differs from the incipiency language of § 7's general prohibition ("may be substantially to lessen competition"), and should therefore be read to require a factual determination of whether the stock ownership *is* being used to lessen competition. *Id.*

[25] 18 U.S.C. § 18a.

[26] The courts have not relied on this notification provision in interpreting the solely-for-investment exemption of § 7 or otherwise in evaluating partial stock acquisitions.

that acquisitions of less than 10 percent of a company's stock, made for investment purposes, do not raise sufficient antitrust concerns to warrant any advance review.

Another source for the meaning of "investment" could be an HSR implementing regulation providing that acquisitions are made "solely for purposes of investment" when the acquirer has no intention of participating in the formulation, determination, or direction of the basic business decisions of the issuer.[27] The FTC's Statement of Basis and Purpose for this regulation identifies six types of conduct evidencing intent inconsistent with "solely for investment" purposes: (1) nominating a candidate for the board of directors of the issuer; (2) proposing corporate action requiring shareholder approval; (3) soliciting proxies; (4) having a controlling shareholder, director, officer, or employee simultaneously serving as an officer or director of the issuer; (5) being a competitor of the issuer; and (6) doing any of the foregoing with respect to any entity directly or indirectly controlled by the issuer.[28]

While the Clayton Act applies to acquisitions of any part of the "stock" of another company, the HSR Act applies more narrowly to acquisitions of "voting securities." The Act defines voting securities as any securities entitling the holder to vote for the election of directors.[29] This could reflect a view that acquisitions of non-voting stock raise less antitrust concern. In this regard the HSR rules indicate that an acquisition of stock that does not allow for voting on directors should raise less antitrust concern because it confers "far less significant" power.

Thus, the HSR Act and regulations add some clarity in distinguishing partial ownership acquisitions that are merely passive investments from those that confer control over the acquired firm. But the law remains

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[27] 16 C.F.R. § 801(1)(i).

[28] 43 Fed. Reg. 33,450, 33,465 (1978).

[29] 18 U.S.C. § 18a. The HSR regulations exempt acquisitions of convertible voting securities, but require reporting in advance of the conversion (§§ 801.32 & 802.31). They define convertible voting securities to mean voting securities that do not entitle the holder to vote for directors (§ 801.1(f)(2)). The Statement of Basis and Purpose discusses the antitrust significance of convertible securities:

> From an antitrust standpoint, reporting at conversion is more useful. It is true that before conversion, convertible voting securities may confer upon their holder the power to influence, either directly or indirectly, the management of the issuer. But the conversion price attached to convertibles may make conversion economically unattractive. And the measurement of the potential voting power conferred by convertibles is highly speculative, since conversions by other holders may dilute the potential voting power of the person holding the convertibles. So although a substantial holding of convertible voting securities may give the holder some power to influence management, this power is far less significant than the ability actually to vote securities.

highly uncertain and provides very little guidance for antitrust practitioners trying to assess the antitrust risk of partial stock acquisitions. The economic paradigm set forth below provides a more systematic, principled approach to evaluating partial ownership acquisitions.

III. BASIC ECONOMIC FRAMEWORK

In analyzing the competitive effects of partial ownership, it is necessary to distinguish between two aspects of partial ownership, financial interest and corporate control. Financial interest refers to the acquiring firm's entitlement to a share of the profits of the acquired firm. Corporate control refers to the acquiring firm's ability to control or influence the acquired firm's competitive decision making, including pricing and product selection as well as sale of the company's assets. These two factors have separate and distinct impacts on the competitive incentives of the acquired and the acquiring firm. Financial interest affects the incentives of the acquiring firm, while corporate control affects the incentives of the acquired firm.

In this analysis, we focus on the firms' unilateral pricing incentives. That is, we assume that the firms in the market do not collude, either expressly or tacitly. Instead, we assume that they compete with one another. Each firm sets its price independently and unilaterally, that is, on the assumption that its pricing decision will have no effect on the prices charged by its competitors. For example, we assume that the firms do not attempt to send signals to one another through their pricing decisions. This assumption of unilateral pricing decisions has a long tradition in industrial organization economics, going back to the early 1800s and the work of Antoine Augustin Cournot and Joseph Bertrand, two French economists.[30]

Despite this long history in economics, the 1982 and 1984 Merger Guidelines were mainly premised on an assumption that firms in concentrated industries attempt to collude tacitly and that preventing this collusion should be the primary focus of merger analysis.[31] However, unilateral pricing incentives explicitly were included in the 1992 Merger Guidelines

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[30] ANTOINE AUGUSTIN COURNOT, RESEARCH INTO THE MATHEMATICAL PRINCIPLES OF THE THEORY OF WEALTH (1838, Nathaniel T. Bacon trans., Augustus M. Kelley Publishers 1971); Joseph Louis Francois Bertrand, *Theorie mathematique de la richess sociale,* 67 JOURNAL DES SAVANTS 499 (1838). A modern translation of Bertrand's work by James W. Friedman appears in COURNOT, OLIGOPOLY 73 (Andrew F. Dougherty ed., 1988).

[31] Issues of unilateral pricing incentives were implicit in the leading-firm proviso in these Guidelines, but they were not given any independent analytic focus.

analysis of competitive effects.[32] This now represents the primary approach to horizontal merger analysis.[33]

A. THE DISTINCTION BETWEEN FINANCIAL INTEREST AND CORPORATE CONTROL

In property law, students sometimes are taught that property rights can be viewed as a bundle of sticks that can be divided up among multiple parties in various ways.[34] This bundle of sticks often refers to the various sources of cash flows (positive and negative) flowing from real property. For example, these include the surface land rents, the subsurface mineral rights, the water that flows through the property, the financial exposure from pollution runoff, injuries to people using the property, and so on.

Rights relating to a company's cash flow can also be divided up among multiple participants. In analyzing the effects of the company's structure on competition, we can identify two distinct rights, which we call financial interest and corporate control. Financial interest refers to the right to receive the stream of profits generated by the firm from its operations and investments. Corporate control refers to the right to make the decisions that affect the firm.

In a sole proprietorship, a single individual has a complete financial interest stake. That is, the individual has the right to 100 percent of the profits of the firm. The same individual also has complete control over the company, making the decisions about what price to charge, what products and how much output to produce, how much to invest, and whether to make agreements with other firms (including any agreement to sell the firm).

In other contexts, however, it is not always true that the same person maintains both financial interest and corporate control. For example, consider a partnership owned by two individuals, one with a 51 percent share and one with a 49 percent share. Although their claims on corpo-

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[32] Horizontal Merger Guidelines, *supra* note 1, § 2.2. For a discussion of the economics underlying the 1992 Guidelines, see Janusz A. Ordover & Robert D. Willig, *Economics and the 1992 Merger Guidelines: A Brief Survey*, 8 REV. OF INDUS. ORG. 139 (1993), *reprinted in* COLLABORATIONS AMONG COMPETITORS: ANTITRUST POLICY AND ECONOMICS 639 (Eleanor J. Fox & James T. Halverson eds., 1992).

[33] Jonathan Baker, then-Director of the Bureau of Economics at the FTC, noted that "Unilateral theories are now by far the most common, at least in the memoranda Associate Director Gary Roberts and I have written to the Commission." *Unilateral Competitive Effects Theories in Merger Analysis*, ANTITRUST, Spring 1997, at 21. The Spring 1997 issue of *Antitrust* contains a series of articles that provide a useful introduction to unilateral effects analysis.

[34] *See, e.g.*, Hodel v. Irving, 481 U.S. 704, 717 (1987); Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419, 435 (1982).

rate profits are nearly equal, the majority owner may have complete control over the corporate decision making. This may make no difference if the interests of the two owners are perfectly aligned. However, if the owners' interests are not aligned for some reason, then the majority owner may have the incentive to make decisions at variance with the preferences of the 49 percent owner, and these decisions may have an effect on the competitive performance of the market in which the firm competes. Thus, when the partnership is formed, the 49 percent partner may insist on certain constraints being placed on the controlling partner's decisions. The majority partner also may owe a fiduciary obligation to the partnership that places certain constraints on its decisions.

As a general matter, higher financial interest is accompanied by greater corporate control. This is certainly true in comparing individuals with majority and minority stakes. Where there is no majority shareholder, larger minority shareholders may have disproportionate control as a result of their superior ability to form voting coalitions that can jointly control the outcome.[35]

Modern corporations sometimes have quite complex corporate financial and governance structures in which there is a distinction between voting and non-voting stock. The non-voting shares give the holder a share of the profits but no right to vote for the Board or participate in other decisions. That is, the shareholder has financial interest with no corporate control. This structure can lead to a situation where a shareholder with a minority financial interest controls the firm.[36]

Control by shareholders with a small financial interest sometimes arises because corporations issue multiple classes of stock that differ in their voting power. For example, Class A shares may each come with one vote, whereas Class B shares may come with ten votes each. Board members may be elected by the entire group of shareholders, by a single class, or

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[35] This proposition is consistent with game theoretic analyses of voting, which suggest that an individual's voting power may rise disproportionately with the percentage of votes held by the individual. *See, e.g.*, John F. Banzhaf III, *Weighted Voting Doesn't Work: A Mathematical Analysis*, 13 RUTGERS L. REV. 317 (1968); Lloyd S. Shapley, *A Value for n-Person Games*, ANNALS 28; *see also* John S. Cubbin & Dennis Leech, *The Effect of Shareholding Dispersion on the Degree of Control in British Companies: Theory and Measurement*, 93 ECON. J. 351 (June 1983) (arguing that a controlling shareholding is often smaller than 50%). Additional empirical support for this proposition can be found in Randall Morck et al., *Management Ownership and Market Valuation: An Empirical Analysis*, 20 J. FIN. ECON. 293 (Jan./Mar. 1988) (results suggesting that effective managerial control of the firm can occur with an ownership interest as small as 25%).

[36] As mentioned earlier, in the Northwest/Continental deal that is currently being litigated by the Department of Justice, Northwest owns a 15% financial interest. However, it owns 51% of the voting shares. *See* Amended Complaint, *supra* note 6.

may even be designated by the owner of a particular block of stock. Of course, the control exerted by shareholders with the majority of voting power is not absolute. If it were, the minority (or non-voting) shares would have little value and individuals might not be willing to invest under such terms.

Fiduciary obligations may also affect the relative power of minority shareholders. For example, corporate and securities laws place a fiduciary obligation on the Board of Directors. Partnerships can have similar constraints. This fiduciary obligation essentially amounts to a requirement that the Board must act in the interest of the corporation as an entity, not of the majority, controlling shareholders. This requirement can serve to protect the interests of the minority shareholders. Similarly, antitrust law can create similar constraints by prohibiting joint pricing agreements by shareholder firms that are horizontal competitors.

This distinction between financial interest and corporate control is key to understanding the competitive effects of partial ownership arrangements. In simplest terms, when a firm acquires a partial financial interest in a rival, the acquiring firm's unilateral pricing incentives to compete are reduced at the margin. What about the unilateral competitive incentives of the acquired firm? If the acquiring firm has no control or influence over the rival, acquired firm, that rival's incentives to compete may be unaffected. However, if the acquiring firm also has control over the rival, then the rival's incentives to compete are affected. Thus, to understand the implications of partial ownership interests on competition, it is necessary to analyze financial interest and corporate control as distinct elements.

B. THE IMPACT OF FINANCIAL INTEREST ON THE INCENTIVES OF THE ACQUIRING FIRM

1. *Basic Analysis of Unilateral Pricing Incentives*

To explain the role of the potential separation of financial interest and corporate control, we begin by describing the competitive situation before any acquisitions have been made. We examine the decision calculus of a firm in a market with a number of competitors that each set price unilaterally. (We will refer to this firm as the acquiring firm because later on we will show the effect of an acquisition on its unilateral pricing incentives.) That is, as discussed earlier, we assume that firms each price independently, do not tacitly or expressly collude, and do not try to signal one another with their pricing choices or in other ways. Instead, we assume that each firm reckons that its own price choice will not affect the prices charged by its rivals.

Industrial organization economics generally is premised on an assumption that each firm sets its price in order to maximize its profits. In a perfectly competitive market, this profit maximization leads to a situation in which the firms set prices equal to their marginal costs. However, in an imperfectly competitive market with a limited number of competitors or product differentiation, competition does not generally lead to marginal cost pricing. Instead, each firm takes into account that it has some (possibly limited) control over the price it charges. It realizes that it can charge a higher price, albeit by selling less output. This optimal combination of price and output is affected by the firm's cost, the number of competitors, the degree of product differentiation, and the prices charged by the other firms in the market.[37]

In this type of imperfectly competitive market, a profit-maximizing firm must balance the benefits and costs of a price increase. The cost of a price increase is that it causes some sales to be lost as some customers substitute to products sold by other firms. This is costly to the firm because the profits on those sales are lost. The beneficial effect of a price increase is that each of the remaining sales contributes more profit because of the higher price. The net effect on profits of a proposed price increase is the sum of these two effects. The firm's profit-maximizing price is one at which further price increases reduce the level of profits because the cost outweighs the benefit.[38] This profit maximizing depends, of course, on the degree of competition from other firms and the other factors mentioned earlier. At some level, this same benefit-cost analysis applies to monopolists.[39]

It is useful to illustrate this methodology with a numerical example. Suppose that a firm has constant marginal costs of $80 per unit and has an initial price equal to $100.[40] In determining its profit-maximizing price, the firm must balance the costs and benefits of raising price

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[37] To keep the analysis simpler, we will assume that barriers to entry prevent the entry of new competitors. Of course, if entry is easy and timely, mergers and partial ownership interests are not likely to have durable anticompetitive effects.

[38] This result leads to the classic "marginal revenue equals marginal cost" equation of profit maximization. The price increases up to the profit-maximizing level are profitable, that is, the benefits outweigh the costs. Further price increases above this level reduce profits.

[39] Indeed, this benefit-cost analysis forms the basis for the SSNIP (small but significant and nontransitory increase in price) test for market definition in the Merger Guidelines. In that case, the Guidelines call for a benefit-cost analysis by a hypothetical profit-maximizing monopolist that controls a group of products. *See* Horizontal Merger Guidelines, *supra* note 1, § 1.0.

[40] The example is expanded in Part A of the Appendix.

further.[41] On the cost side, any additional price increase would result in a certain customer loss with an associated reduction in profits equal to the lost $20 margin of price over costs (i.e., $100 minus $80) on each customer lost. It also would result in a benefit—a larger price-cost margin on all the customers that did not switch to rivals. In choosing its price, the firm would balance the benefit and cost.

For example, suppose that at a price of $100 the acquiring firm has sixteen customers. If a 10 percent price increase (to $110) would cause the firm to lose only a single customer, the firm would lose the $20 margin on that customer. However, it would increase its margin by $10 (from $20 to $30) on the fifteen customers retained, for a profit increase on those customers of $150. Thus, the net effect of the price increase would be to raise its profits by $130 (i.e., $150 minus $20). As a result, this firm would have the incentive to raise its price.[42]

Alternatively, suppose that the firm feared that a 10 percent price increase would cause the loss of eight customers, four to one of its competitors and two each to two others. This assumed customer loss would reduce its profits by $160 (i.e., 8 times $20). The gain from an increased margin on the remaining eight customers would be only $80 (i.e., 8 times $10). The net impact on the firm would be to reduce its profits by $80. Thus, the firm would not have the incentive to raise price to $110. It would earn greater profits at a price of $100. Assuming that it were profitable for the firm to raise price up to $100, this would be its profit-maximizing price.[43]

2. *Impact of Merger*

The firm's incentives change if it acquires full ownership of one of its competitors in a merger transaction, which may give the firm an incentive to charge a higher price. This is because some of the customers it would lose when it increases price are diverted to its merger partner. Thus, a merger allows the acquiring firm to recapture some of the profits that would be lost from the price increase absent the merger. Once it takes this customer recapture into account, it would perceive a greater gain from a price increase.[44]

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[41] The firm also will evaluate the profitability of reducing price with a similar analysis.

[42] Price reductions will also be evaluated. In this example we assume that price reductions are not profitable.

[43] This example only considers that possibility of a $10 price increase. In a more complete example, as in the Appendix, larger and smaller price increases and decreases would be evaluated too.

[44] This is the standard economic analysis of how a merger changes unilateral pricing incentives. Horizontal Merger Guidelines, *supra* note 1, § 2.21.

This analysis can be illustrated by expanding the previous numerical example in which the premerger, profit-maximizing price was $100 and a price increase to $110 was unprofitable because of the loss of eight customers. Suppose that the firm acquires by merger the competitor that captures four of its customers when the acquiring firm raises price. If the acquiring firm raises price to $110, it would lose eight customers as before. However, four of those lost customers now would be diverted to its merger partner, in which it has acquired a 100 percent financial interest. Because of this financial interest, the acquiring firm would recapture some of the lost profits. For example, if the acquired firm were to charge a price of $100 and has costs of $60, the acquired firm would earn an additional profit of $160—that is, $40 on each of the four customers it gains. Once the acquiring firm takes this additional source of profits into account, the acquiring firm would gain the incentive to raise price to $110. Its profits as a producer would fall by $80, but its profits as an investor in the acquired firm would rise by $160. Thus, after the acquisition, the net effect of the price increase would be to raise its total profits by $80, rather than reduce its profits by $80 as before the acquisition. Thus, after the merger, it would earn more at the price of $110 than at the price of $100.

In a merger, the acquiring firm controls the pricing and output decisions of the acquired firm and also may raise the price charged by the acquired firm. However, a key point worth stressing here is that the increased unilateral incentive of the acquiring firm to raise price demonstrated in this example does not require or assume that the acquiring firm controls the acquired firm. The increased unilateral pricing incentive flows directly from the acquiring firm's financial interest in the acquired firm. If this were not a merger, but rather the acquisition of all of the acquired firm's profits as a passive investor, and if the acquired firm did not raise its price following the transaction, the acquiring firm still would have this incentive to raise its price.

When the acquiring firm also obtains corporate control over the acquired firm, as it would in a merger, the unilateral pricing incentives of the acquired firm also change. This change in incentives may lead the acquired firm to raise its price. The effect of the merger on the incentives of the acquired firm is analogous to the effect on the incentives of the acquiring firm. That is, an increase in the acquired firm's price increases the sales volume and profits of the acquiring firm as some fraction of the customers lost by the acquired firm from the price increase choose to substitute to the acquiring firm. This, in turn, raises the profits of the acquiring firm. If the acquiring firm controls the pricing of the acquired firm, it takes these higher incremental profits into account in

setting the price of acquired firm. These incentive issues are analyzed in more detail *infra* at Part C.

The foregoing analysis is essentially a description of the factors that lead to price increases when producers of differentiated products merge.[45] In the post-merger equilibrium, both prices tend to rise because the merged firm internalizes the impact of the pricing decisions on the profits of the previously independent firms.[46]

3. *Impact of Partial Ownership Interests*

This incentives analysis applies directly to the case in which the acquiring firm purchases less than a 100 percent financial interest in the acquired firm. The acquiring firm still takes the customer recapture into account in its decision calculus. However, if the acquiring firm has only a partial financial interest, it only factors that partial interest into its revaluation of incremental profits from a price increase. Thus, the acquisition increases the acquiring firm's incentive to raise its price. However, the incentive of the acquired firm to increase prices is smaller than it would be in a full merger.[47]

To illustrate the effect of a partial financial interest on the unilateral pricing incentives of the acquiring firm, we return to the previous example,[48] where a 10 percent price increase by the acquiring firm from $100 to $110 causes a loss of eight units of demand, four of which are diverted to the acquired firm. Absent the transaction, the acquiring firm suffers harm of $160 from losing eight customers (i.e., a margin of $20 for each of the eight units lost) and a benefit of $80 (i.e., an increase in margin of $10 for each of the eight units retained), for a net reduction in profits of $80. The price increase benefits the acquired firm because it gains four new units of sales, leading to an increase in its profits of $160 (i.e., a margin of $40 for each of the four customers). Thus, absent the transaction, the acquiring firm does not have the incentive to raise price to $110. In contrast, a complete merger gives the acquiring firm the incentive to raise price to $110.

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[45] The effect of a merger among competitors with undifferentiated products is similar, though the incentives are more likely to involve output reductions than price increases.

[46] This example assumes that entry, efficiencies, and other competitive factors do not dominate the incentive effects examined here.

[47] The impact on the acquired firm's incentives is more complicated, as we will examine in the next Part. Those incentives depend on the acquiring firm's degree of control. That could range from no control at all (silent financial interest), to partial control, to total control. As discussed already, a firm with a minority financial interest nonetheless can have total control.

[48] For further details, see Part A of the Appendix.

Suppose instead that the acquiring firm purchases a 25 percent ownership share in the acquired firm. In making its pricing decision, it now would reason that the price increase would raise the profits of the acquired firm by $160. As a 25 percent owner, it would factor into its benefit calculation that it is entitled to 25 percent of these profits, that is, $40, at least if the profits accrue to the shareholders. Because it would take this $40 as an additional benefit to the price increase, it would see that the net effect of the price increase on its profits would be a loss of $40, not the loss of $80 it anticipated absent the ownership share or the gain of $80 it would anticipate from a full merger.

This incremental $40 benefit would not be large enough to tip the profit scales positive. However, if the example were expanded to examine other potential price increases, a somewhat smaller price increase might be profitable. For example, suppose that a 2.5 percent price increase to $102.50 causes the acquiring firm to lose two units of demand, one of which is diverted to the acquired firm. In this case, before the acquisition of a partial ownership interest, the loss of the two customers would reduce the acquired firm's profits by $40, but the increased $2.50 margin on the remaining fourteen customers would increase its profits by $35, for a net loss of $5. However, if the acquiring firm has a 25 percent share in the acquired firm and the acquired firm gains one of the two customers diverted and earns a margin of $40 on the diverted customer, then the acquiring firm recaptures $10 (i.e., 25 percent of $40, the acquired firm's margin on the additional unit). Thus, the net effect on its profits becomes a net gain of $5 instead of a loss of $5. The conclusion is that a partial financial interest increases the acquiring firm's incentives to raise price, but not by as much as a full merger that gives the acquiring firm a 100 percent financial interest.[49]

This unilateral incentives analysis applies to the acquiring firm. The impact of the acquisition on the unilateral pricing incentives of the acquired firm depends on how the transaction affects the governance of the acquired firm. This is the issue of corporate control and is the second element in the evaluation of the competitive effects of partial ownership interests.

C. THE IMPACT OF CORPORATE CONTROL STRUCTURES ON THE INCENTIVES OF THE ACQUIRED FIRM

The pricing incentives of the acquired firm will depend on the governance structure of the acquired firm, in particular, on the degree of

[49] The proportionality result—that a 25% financial interest leads to a 2.5% price increase, whereas a 100% financial interest of a merger leads to a 10% price increase—is an artifact of the example, not a general result.

control that the acquiring firm has over the decision making of the acquired firm. As discussed already, one generally assumes that the larger the acquiring firm's financial interest in the acquired firm, the greater its degree of control will be. However, this relationship is not immutable. The degree of control obviously also is related to the structure of the financial interests of the other owners. For example, a 49 percent owner may have no control if one other owner has 51 percent. But a 25 percent owner may have effective control if all the other owners have only 1 percent each. The degree of control also is significantly affected by the governance structure of the acquired firm and the constraints imposed by corporate law in the relevant jurisdiction. Therefore, analysis of partial ownership transactions and joint ventures must pay close attention to the governance structure.

At one extreme on the range of corporate control structures is the case of no control at all, or what we call silent financial interest. At the other extreme is total control of the acquired firm by the acquiring firm. In the middle are a variety of partial control scenarios.

1. *Silent Financial Interest*

A corporate control structure characterized by a silent financial interest is one in which the acquiring firm is entitled to a share of the acquired firm's profits but has no power to control or even influence the decisions of the acquired firm. Instead, the acquired firm acts as if it were an entity independent of the acquiring firm. Silent financial interest may arise from the issuance of non-voting stock, enumerated restraints on decision-making power of the acquired firm, or the acquisition of a financial interest too small ever to be decisive. Silent financial interest does not lead to any change in the incentives of the acquired firm.[50]

2. *Total Control*

At the other extreme is a governance structure that leads to the acquiring firm having total control over the significant competitive decision making of the acquired firm. An acquiring firm obviously has a total control position in a merger. A majority stake in the acquired firm also could lead to total control unless it is constrained by the corporate bylaws (as in silent financial interest) or the general strictures of corporate law (as in the case of fiduciary obligation discussed later). Total control also can arise even where the acquiring firm has a minority financial interest. For example, the acquiring firm with a minority financial interest none-

[50] This is the first-round effect. Once the acquired firm raises its price, the acquiring firm and the other firms in the market then may have an incentive to raise their prices in response.

theless may be designated as the operating partner or it may own a majority of the voting stock. Total control by a large minority shareholder also can occur when the other shareholders are very small so that they cannot form a coalition to block the preferred decisions of the dominant shareholder.

Total control may arise from corporate governance rules requiring supermajority votes for certain significant corporate actions. For example, suppose that a firm's corporate governance rules require a supermajority vote of 75 percent before the company can incur any capital expenditures above a $10 million threshold. In these circumstances, a 30 percent shareholder alone can block any proposal to build a new plant, for example, in a geographic area where that shareholder operates a competing business.[51]

Total control also can arise sometimes even when the acquiring firm has a small, non-dominant financial interest and is not designated as the operating partner. This can occur if the acquiring firm has median preferences over key competitive decisions. In this situation, its vote can be decisive to the outcome because it can form a majority voting coalition to adopt its most preferred alternative.[52]

Total control sometimes leads to the largest and potentially the least competitive incentives and outcome of all the control scenarios. Prices are highest and output is lowest, if other competitive factors remain constant. This outcome flows from a type of free-rider problem arising because the acquiring firm gains a benefit from the acquired firm charging a higher price but only pays a share of the cost. A higher price for the acquired firm leads to more sales for the acquiring firm. Where the acquiring firm has a large financial interest, its incentive to raise the price of the acquired firm is constrained by the lost sales suffered by the acquired firm if the acquired firm raises its price above its indepen-

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[51] The European Union has considered the existence of supermajority voting rights in determining whether a transaction constitutes a reportable "concentration." Commission Notice on the Notion of a Concentration, [1994] O.J. (C 385) 5; Commission Notice on Calculation of Turnover, [1994] O.J. (C 385) 31. In this regard, an acquisition of a 40% interest may not be reportable when the acquired firm's corporate governance rules require basic majority votes. The existence of supermajority voting requirements, however, may make this partial acquisition subject to mandatory review.

[52] The median preference is in the middle, that is, where half of the owners of the remaining voting stock would prefer a higher outcome than the outcome preferred by the owner with the median preference, and the owners of the other half of the remaining voting stock would prefer a lower outcome. In this situation, the median shareholder can form a winning coalition with one or the other group to adopt its most preferred outcome. A unique median voter does not always exist and governance and voting rule may limit its power, as discussed *infra* Part IV.A.

dent, profit-maximizing level. However, if the acquiring firm's financial interest is small, it takes a free ride on the losses suffered by the acquired firm and borne mainly by others. The negative effect suffered by the acquired firm from the smaller profits earned off the acquired firm may be swamped by the positive effect of the acquired firm's higher price on the profits of the acquiring firm's own operation.[53] Thus, the acquiring firm may prefer that the acquired firm charge a very high price.[54] In the limit, if the acquiring firm holds a minuscule financial interest but has total control, this free-rider problem even may lead the acquiring firm to want to shut down the acquired firm. This is because it would gain the benefit of more customers diverted from the acquired firm without bearing a significant share of the costs.[55]

Finally, total control by a firm with a small financial interest can lead to an outcome that is perverse to the interests of the stockholders in aggregate. The controlling shareholder does not in any sense represent the average of the owners, even if its preferences actually are similar to the other shareholders. For this reason, the corporation may have the incentive to choose a governance structure that prevents the total control governance outcome.

3. *Partial Control*

In the middle are a whole range of partial control scenarios. These involve structures in which the acquiring firm may influence the decisions of the acquired firm but not totally control them. In these partial control scenarios, the decision makers of the acquired firm take into account the fact that certain of its shareholders hold financial interests in competing firms. With partial control, the influence of each shareholder is constrained by the other shareholders of the acquired firm. The influence of these shareholders also may be constrained by the corporate charter, corporate law, stock exchanges, and antitrust. Because there is no unique way to take these multiple and potentially conflicting interests into account, many outcomes are possible. We have identified a number of relevant scenarios regarding partial control over the acquired firm, which

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[53] In carrying out this decision calculus, the acquiring firm with a 25% financial interest in the acquired firm would reason that it bears only 25% of the acquired firm's lost profits associated with its price increase. But, to the extent that the acquired firm's customers switch to the acquiring firm, the acquiring firm receives 100% of the profits generated by the new sales. This may create a large incentive to raise the acquired firm's prices.

[54] *See* Nye, *supra* note 10, at 489.

[55] This free-rider problem leads to a competitive benefit when the acquiring firm increases its financial ownership of the acquired firm. This reduction in the free-rider effect might be used to defend an increase in a partial ownership share from an antitrust challenge.

we refer to as fiduciary obligation, Coasian joint control, proportional control, and one-way control. There also may be other scenarios that may be relevant in particular cases.[56]

The pricing incentives of these partial control scenarios vary along a continuum. The most competitive pricing incentives arise in the case of fiduciary obligation. These incentives replicate the incentives of silent financial interest in which the acquiring firm has no control at all over the acquired firm. The least competitive of the partial control scenarios is Coasian joint control, which replicates a full merger. Proportional control and one-way control lead to outcomes in between these two ends of this continuum. All of these partial control scenarios lead to more competitive incentives for the acquired firm than does total control.

a. Fiduciary Obligation

Fiduciary obligation refers to a scenario in which control by the acquiring firm is constrained by legal rules that create an obligation to serve the interests of the minority shareholders, in particular those with no other holdings. These constraints can be built into the corporate charter or they may be required by the public stock exchange on which the shares trade. They also may arise from corporate law or antitrust law. Either way, in making decisions that affect the acquired firm, the Board of Directors of the acquired firm is constrained to ignore the impact of its actions on the acquiring firm, even if the acquiring firm has a large financial interest in the acquired firm. Instead, the Board must manage the acquired firm to act like an independent, stand-alone entity. It is for this reason that the acquiring firm's partial ownership may become effectively passive with regard to competitively sensitive issues. A partial ownership interest may enable the acquiring firm to appoint one or more directors. The acquiring firm's Board appointees can vote, but not in the private self-interest of the acquiring firm. Thus, the competitive incentives of the acquired firm are equivalent to those in the silent financial interest structure.

Some might question whether these fiduciary duties provide any real constraint, in particular, whether they can prevent a shareholder with interests in competing firms from controlling or influencing the acquired firm to take its competitive interests into account. It can be argued that it would be difficult for independent shareholders to detect and prove such a violation of fiduciary obligation. It is one thing to show that a

[56] For example, the Banzhaf and Shapley indices of voting power, *supra* note 35, would predict intermediate outcomes that satisfy certain axioms of fairness and relative voting strengths.

firm made a sweetheart deal to lease a building from a director at an above-market price. It is arguably much more difficult to prove that the Board set a price of $110 (to divert customers at the margin to the competing firms owned by one or more shareholders) rather than a price of $100, that would maximize the stand-alone profits of the acquired firm. Without clear evidence, courts might defer to the business judgment of the Board.

However, this strong view may ignore the role of independent, public directors on the Boards of public companies and the public disclosures that must be made under securities laws. These directors owe clear allegiance to the company and the independent shareholders, not the interests of the shareholders who own competing firms. They would likely vote for decisions that were in the interest of the acquired firm as a stand-alone entity, not in the interests of the shareholders who compete with the acquired firm. To side with those shareholders with competing interests would be a clear violation of the fiduciary duties of these directors. If the Board takes actions that favor competing companies at the expense of the independent shareholders, these independent directors might well have the incentives, expertise, and information needed to prove the violation of the fiduciary duties. They are also well situated to publicize the violation.

It could be argued that the interested shareholders might use their influence to try to remove independent directors that behaved too independently. However, this might be a risky tactic. If the interested shareholders were to remove the independent directors for voting according to their fiduciary obligation, or if they blocked certain disclosures, such conduct could raise serious legal and regulatory issues and expose the Board or the interested shareholders to significant legal risk. Thus, it seems far from settled that one or more of the shareholders, even if they collectively had a majority interest, could cause a company to pursue a course of conduct that advances their interests while conflicting with the best interests of the company. In short, the degree of control under these circumstances remains an unsettled issue.

b. Coasian Joint Control

To many economists, Coasian joint control represents the paradigmatic governance structure. In this structure, the managers of the acquiring firm try to maximize the joint profits of both the acquired firm and the acquiring firm. The managers of the acquired firm act similarly. In this way, they make the same decisions that they would if they were actually merged. Then, they divide up the joint profits in some agreed-upon manner. We refer to this as the Coasian outcome or Coasian joint control

because it satisfies the tenets of the Coase Theorem in the absence of transactions costs.[57] It leads to competitive incentives for both the acquired and acquiring firm equivalent to those in a full merger.

Like most Coasian theoretical outcomes, however, this outcome faces the problem of real-world transactions costs. In the partial ownership structure, there are two key types of transactions costs—legal constraints and strategic behavior. The legal constraints involve antitrust law, in addition to breach of fiduciary duty. If the acquiring firm has a minority financial interest in the acquired firm, joint profit-maximization and side payments between them may constitute price fixing. Such Coasian joint control involves two independently owned and operated firms that are setting price jointly and dividing up the profits. There is no integration of production facilities or technology. Indeed, this behavior might well fall under the per se rule.[58]

The transactions costs based on strategic behavior are the familiar ones discussed in the economic theory of collusion.[59] Although the two firms have a joint incentive to cooperate, they have unilateral incentives to deviate from the cooperative outcome to maximize independent profits. For example, the owner of the acquiring firm would have the incentive to "promise" to raise its price up to the cooperative (merger-equivalent) level, but then secretly cut prices to increase its profits at the expense of the acquired firm. After all, the owner has a 100 percent stake in the acquiring firm but only a partial financial interest in the acquired firm. The managers of the acquired firm face a similar situation. One of their shareholders, the owner of the acquiring firm, wants them to cooperate. But the other shareholders would prefer that the acquired firm cheat by secretly cutting prices. Thus, both types of transactions costs may prevent the Coasian outcome from being achieved.

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[57] The Coase Theorem states that in the absence of transactions costs, parties will negotiate to the joint wealth-maximizing outcome, regardless of the allocation of legal rights.

[58] The concerted action of the acquiring and acquired firm may be outside the reach of the Sherman Act in the event the acquiring firm is deemed to control the acquired firm under the *Copperweld* doctrine. Copperweld Corp. v. Independence Tube Corp., 467 U.S. 752, 770–71 (1984) (parent company and wholly owned subsidiary lack sufficient independence to conspire). District courts have extended *Copperweld* to situations in which a firm owns 51% or more of the shares of the other and to other situations where there is apparent power to control. *See* ABA SECTION OF ANTITRUST LAW, ANTITRUST LAW DEVELOPMENTS 25–28 (4th ed. 1997). In most partial ownership situations, where the acquiring firm holds less than 50% of the voting shares, the firms will be treated as distinct entities under *Copperweld*, and hence subject to the per se rule against price fixing by horizontal competitors.

[59] *See* F.M. SCHERER & DAVID ROSS, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE, chs. 7–8 (3d ed. 1990); *see also* Horizontal Merger Guidelines, *supra* note 1.

c. One-Way Control

One-way control refers to a scenario in which the acquiring firm has enough power over the acquired firm to force the acquired firm to maximize joint profits and not secretly cheat. However, this joint profit-maximization only applies to the acquired firm. The acquiring firm continues to act in its own self interest, making decisions that take into account the fact that it has only a partial ownership stake in the acquired firm.

One-way control leads to more competitive incentives than does Coasian joint control. This is because the controlling firm does not fully internalize the free-rider problem in the one-way control scenario. In contrast, in Coasian joint control the effects are completely internalized.

d. Proportional Control

Proportional control refers to a slightly different scenario in which the Board and managers of the acquiring firm take into account their shareholders' interests in other firms. However, rather than trying to maximize joint profits, they take the shareholders' interests into account in proportion to their financial interests in the acquired firm. For example, if the acquiring firm is the only competitor with a financial interest in the acquired firm and it has a 25 percent stake, then the acquired firm's managers will make pricing and output decisions as if the acquired firm has a 25 percent financial interest in the acquiring firm. Proportional control is more relevant in the joint venture context when the acquired firm is the joint venture entity and there are a number of competitors with financial interests in that entity.

For the case of undifferentiated products, proportional control can lead to more or less competitive pricing incentives than one-way control. The incentives of the acquiring firm will be the same under one-way and proportional control. However, the acquired firm might behave more or less competitively under proportional control. In this context, both one-way and proportional control structures lead to competitive incentives that are in between fiduciary obligation and Coasian joint control. Fiduciary obligation is equivalent to silent financial interest and Coasian joint control is equivalent to a full merger. For the homogeneous product case, total control is the least competitive of all the scenarios.

For the case of differentiated products, the analysis is more complicated and the rankings cannot be proved in general. They depend on the details of market structure. For example, total control can lead to higher or lower prices than a full merger. Full evaluation of alternative

corporate control structures requires the use of the quantitative methodologies discussed below.

IV. APPLICATION TO JOINT VENTURES

The analysis so far has been limited to a single partial ownership interest in a single acquired firm by a single acquiring firm. However, this economic framework can easily be extended to the case of joint ventures, that is, entities that are owned by and compete with a number of competing firms.[60]

Joint ventures obviously are quite common in the modern economy. They range from jointly owned oil pipelines and automotive ventures to cable programming services and biotechnology ventures. The governance structures of these ventures involve combinations of the corporate control structures discussed earlier.

Joint ventures may be horizontal, vertical, or both. A horizontal joint venture is a jointly owned entity whose parents compete with the venture and each other. A vertical joint venture is a jointly owned entity whose parents supply inputs to the venture, produce outputs that are complementary to the output of the venture, or produce outputs using an input produced by the venture. Joint ventures also can involve both vertical and horizontal elements. For example, a joint venture may be jointly owned by firms that are vertically integrated and compete with the venture and each other in at least one of the markets.

A. HORIZONTAL JOINT VENTURES

Horizontal joint ventures are entities whose parents compete with the joint venture and each other. For example, before being fully acquired by Time Warner, Turner Broadcasting Company was a venture owned partially by Time Warner and TCI. Turner owned a number of cable programming services (e.g., CNN, WTBS, TNT). Those services arguably competed with services fully or partially owned by Time Warner (e.g., E!, HBO, CourtTV) and TCI (e.g., Discovery Channel, Starz!, Encore).

While the analysis of horizontal joint ventures flows directly from the previous analysis of partial ownership interests, it is more complicated because there are multiple parents with partial ownership interests and

[60] Antitrust analysis of joint ventures also involves the analysis of foreclosure and other potential exclusionary conduct by the joint venture and its members. *See, e.g.*, Dennis W. Carlton & Steven C. Salop, *Symposium: High Technology, Antitrust & The Regulation of Competition: You Keep on Knocking But You Can't Come In: Evaluating Restrictions on Access Rules to Input Joint Ventures*, 9 HARV. J.L. & TECH. 319 (1996). This analysis of exclusionary conduct, however, is beyond the scope of this article.

there is a larger set of possible governance structures. The issues surrounding the total control governance structure also become more complicated and more interesting in the context of joint ventures.

The pricing incentive effects of the parents' partial financial interests are identical to the previous analysis. For example, consider a joint venture that is owned by three competitors ("parents") and competes with its parents and other firms in the market. Because each of these acquiring firms has a financial interest in the venture, each of its pricing incentives is compromised somewhat. Each parent realizes that a higher price for its product will drive some sales to the venture, and it will obtain a share of the higher profits earned by the venture as a result.

The pricing incentives of the joint venture entity depend crucially on its governance and ownership structure. The simplest cases to analyze involve structures in which every parent has a silent financial interest or the venture's control is fully constrained by the fiduciary obligations to independent, minority shareholders. In these structures, the management of the venture ignores the identity of its shareholders as competing firms and acts simply to maximize the profits of the venture. The parents may wish that the venture management would take their interests into account, but that does not occur.

As discussed earlier, these two equivalent governance structures can arise because of constraints created by either the corporate charter, corporate law, or antitrust law. In a multi-parent joint venture, constraints could be voluntarily adopted if the parties find themselves in some type of governance stalemate. For example, the parents may prefer silent financial interest to the dysfunctional outcome of total control. This could lead them to cede effective control to the management of the venture.

The total control structure, in principle, can arise in three ways, as discussed earlier. First, one of the venture's parents may be designated as the operating partner under the joint venture operating agreement. Second, one of the parents may have an unconstrained majority stake that gives it complete control. Third, the venture partners may make decisions by majority vote with an unconstrained agenda and one of the venture's parents (the "median" shareholder) may be decisive in these votes. This decisive shareholder may have minority financial and voting interests. Indeed, its financial and voting interests may be quite small.[61]

[61] For example, suppose that a venture has 101 shareholders, each with slightly less than a 1% financial interest. Suppose that these shareholders differ in their interests in competing firms and that they differ in the price they each prefer the venture to set. To be concrete, suppose that shareholder 1 would prefer the lowest price p_1, shareholder 2

We have already discussed how the pricing incentives of the joint venture (the acquired firm) under total control can be less competitive than even a full merger. This result comes from the free-rider effect. A controlling shareholder with a minority stake in the joint venture can gain a larger benefit from the joint venture entity charging a higher price than the loss it suffers from the reduced profits of the joint venture. The controlling shareholder in the total control structure does not take into account the harms suffered by the other shareholders from the reduced joint venture profits. Instead, it takes a free ride on these losses.

In the total control structure, the competitive pricing incentives are worse when the controlling shareholder's financial interest in the venture is proportionately lower. This possibly counter-intuitive result arises because a lower financial interest increases the magnitude of the free-rider effect. In the limiting case of a controlling shareholder with a minuscule financial interest in the venture, that shareholder may have the incentive to shut down the venture altogether. By doing so, the profits of the venture fall to zero, but the profits of the parents, including the controlling shareholder, rise because the competing output of the venture is eliminated. If the controlling shareholder is entitled to only a minuscule share of the venture's profits, it virtually ignores that source of wealth reduction in favor of a focus on the increased profits earned from its own production entity.

This analysis of the relationship between pricing incentives and the financial interest of the controlling shareholder generates an interesting efficiency rationale for mergers between the shareholders of a joint venture. If the controlling shareholder in a joint venture acquires the interest of another shareholder, its pricing incentives become more competitive, not less. This defense of joint venture consolidation results because the magnitude of the free-rider effect falls when its financial interest rises.

A merger between the controlling shareholder and a competing firm that also owns a stake in the joint venture involves conflicting effects on incentives. On the one hand, by gaining control over a competitor, the competitive pricing incentives of the controlling shareholder's firm are

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the second lowest price p_2, and so on up to shareholder 101, who prefers the highest price p_{101}. That is, $p_1 < p_2 < \ldots < p_{51} < \ldots < p_{101}$. In this case, stockholder 51 is the median voter and its preferred price p_{51} would be adopted in an unrestricted voting agenda. Its preferences are decisive because its preferred price p_{51} would defeat any other pricing proposal. Yet, stockholder 51 has this power despite the fact that it has less than 1% of the financial interest. If there are multiple issues or a restrained voting agenda, the analysis is more complicated and the results may change dramatically, as discussed *infra* text accompanying notes 64–66.

lessened. It now takes into account that when it raises price, sales lost to the newly acquired firm may be recaptured as profits arising from the financial interest in the acquired firm. On the other hand, by increasing its share of the joint venture, the controlling shareholder's pricing incentives for the venture become more competitive. Which effect dominates is an empirical matter that depends on the margins, market shares, and diversion ratios of the firms.

A perhaps even more striking implication of total control involves the performance of the corporation itself, rather than just competitive effects in the market. In particular, the decision chosen by the controlling shareholder with a partial financial interest does not reflect the collective preferences of all of the shareholders. This result occurs even when the controlling shareholder's preferences are the same as or are the average of the others. Indeed, because of the free-rider effect, a controlling minority shareholder in the total control structure does not make the same decision that it would if it were the sole owner of the venture.[62] For these reasons, a governance structure that gives total control to one minority shareholder is dysfunctional. This result creates a collective incentive for the shareholders to adopt a different governance structure.

This dysfunctional outcome can be illustrated clearly with the following example. Suppose that a horizontal joint venture is formed by five competing firms, called *A, B, C, D,* and *E,* each of which owns a 20 percent share of the venture. Suppose that each of these parent shareholders has identical demand and costs. As a result, each has the same individual preferences as to the price to be charged by the venture. In particular, suppose that if any of the five firms were the sole owner of the venture, it would choose a venture price of $100. Similarly, this is the price that the five shareholders would agree is the best price for all of them collectively. Of course, this price is higher than the price that would be set by an independent, stand-alone owner of the venture that did not compete with the venture. This is the standard economic incentive effect of a merger.

Now suppose that firm *C* is the controlling minority shareholder. Because of the free-rider effect, firm *C* would force the joint venture to charge a significantly higher price, say $150. That is the same price that any one of the five parents would charge if it were the controlling minority shareholder. Yet this price set by the controlling shareholder

[62] The divergence between the controlling shareholder's decision and the preferences of all of the stockholders is larger when the minority stake of the controlling shareholder is smaller.

does not reflect the best price from the point of view of all the shareholders collectively.[63]

This same basic result occurs when there is diversity among the underlying preferences of the shareholders. For example, suppose the five parents have different costs—firm *A* with the lowest, up to firm *E* with the highest costs. A higher cost firm would prefer that the venture charge a higher price than would a lower cost firm. For example, suppose that if firm *A* were the sole owner, it would have the venture price at $50, firm *B* a price of $75, firm *C* a price of $100, firm *D* a price of $125, and firm *E* a price of $150. In this example, firm *C* is the median shareholder and its preferred price is the average of the preferred prices of the five shareholders, viewing each as the sole owner. If the five parents were merged, suppose that they also would choose the average price of $100, the price that firm *C* also would charge if it were the sole owner. Thus, $100 is in some sense the best price for the group. In contrast, if firm *C* were the controlling shareholder with a 20 percent financial interest, it would set a price above $100. The median shareholder's decision does not reflect the preferences of the shareholders collectively. As shown in the example, this result can occur even when the median shareholder's preferences are also the average preferences of all the shareholders. The analysis here makes it clear that the price chosen by a median shareholder with total control also is a dysfunctional price from the point of view of the shareholders collectively.

The claim that the median voter (here, shareholder) has total control has another flaw that has been attacked by political economists studying public choice. In a more complicated setting in which there are multiple dimensions to the voters' preferences, there generally is no unique median voter. As a result, there is no stable voting coalition that can control the outcome.[64]

For example, suppose that the Board's decisions must go beyond price (or output). Suppose the Board also must decide what type and variety of products to sell, decisions that can affect competitors differently. In addition, suppose it also must decide how much and what type of advertis-

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[63] This is a standard result when there is free riding. In a standard pollution context, for example, every individual would choose to pollute less, if he or she were the sole member of society. Society can agree collectively that less pollution would be better, but each individual unilaterally chooses to pollute in excess of this amount.

[64] *See* Richard D. McKelvey, *Intransitivities in Multidimensional Voting Models and Some Implications for Agenda Control*, 12 J. ECON. THEORY 472 (1976). A useful bibliography of results in social choice theory is contained in David Austen-Smith & Jeffrey S. Banks, *Social Choice Theory, Game Theory, and Positive Political Theory*, 1 ANN. REV. POL. SCI. 259 (1998).

ing to carry out, decisions that also affect competitors differently, and not in the same way as would the product selection decision. In this more complicated setting, in which different Board members prefer different combinations of choices, there generally is no way of lining voters up so that one voter is the median voter over all possible combinations of choices. As a result, aggregate preferences will not be transitive and votes will cycle, never reaching a stable outcome.[65]

Stability could be re-achieved in these situations by limiting the voting agenda in some way, either in the charter or by giving control over the agenda to someone. However, in this case, the median voter for any particular issue may no longer have complete control over the outcome. Instead, a degree of control is held by the individual controlling the agenda, who can select the agenda knowing that the median voter *for that particular agenda* will determine the outcome.[66]

Another difficulty in applying voting theory to the corporate contest is that the identity of the median voter for any particular issue also may not be clear. On the one hand, the determination could be based on the membership of the Board. In this case, an independent, public director may be the median, decisive director. On the other hand, the determination could be based on the voting shares of the stockholders. The rationale for this latter approach is that the shareholders elect (and can replace) directors.

B. VERTICALLY INTEGRATED JOINT VENTURES

Some joint ventures are comprised of vertically integrated companies that produce complementary products as well as competing products. In these joint ventures, the parents compete in one or both of the markets in which the firms produce. When joint ventures are vertically as well as horizontally integrated, another competitive element is added to the analysis.[67] The joint venture's parents have an incentive to maintain low joint venture prices. By setting a low output price for the joint

[65] That is, if there are three options open to the voters, option *A* might defeat option *B* might defeat option *C*, but then option *C* might defeat option *A*. This failure of transitivity is a general result in the theory of multidimensional voting. *See* KENNETH ARROW, SOCIAL CHOICE AND INDIVIDUAL VALUES (2d ed. 1963). For a discussion and legal application in a different area of the law, see Frank H. Easterbrook & Daniel R. Fischel, *Voting in Corporate Law*, 26 J.L. & ECON. 395 (1983).

[66] Thomas Romer & Howard Rosenthal, *Political Resource Allocation, Controlled Agendas, and the Status Quo*, 33 PUBLIC CHOICE 27 (1978); Thomas Romer & Howard Rosenthal, *Voting Models and Empirical Evidence*, 72 AM. SCIENTIST 465 (1984).

[67] Vertically integrated joint ventures also raise important exclusionary conduct issues regarding access and exclusivity. *See, e.g.*, Carlton & Salop, *supra* note 60. These exclusion issues are ignored in this part.

venture's product, the parents can sell more of the complementary product that they produce and thus increase their profits.[68]

In a vertically integrated joint venture, the analysis of competitive incentives is more complicated because of the combination of the horizontal and vertical elements. For example, suppose the venture is governed by the Coasian joint control structure, where the managers of the venture attempt to maximize the sum of the profits of the venture and its parents. On the one hand, the horizontal overlap between the venture and its parents reduces the competitive incentives of the venture. In setting its output price, the venture takes into account the fact that a higher output price will divert sales to the firms owned by the parents, increasing the profits of the parents' firms. On the other hand, the vertical relationship between the venture and its parents enhances the competitive incentives of the venture. In setting its price, the venture also takes into account the fact that a higher output price will reduce demand for the inputs (or complementary products) sold by the parents, reducing the profits of the parents' firms. Which effect dominates depends on the relative margins of the various products and other factors. Where the vertical effect dominates, a vertically integrated joint venture has more competitive pricing incentives than would an independent, stand-alone entity or a joint venture in which the parents had silent financial interests.

In a vertically integrated joint venture, total control may increase competitiveness of the entity's pricing incentives. This would occur when the controlling shareholder's vertical interests in the entity exceed its horizontal interests. In this case, the controlling shareholder's profits are increased more by having the venture set a low output price than a high output price. This situation would arise when its incremental profits from selling inputs (or complementary products) exceeds its incremental profits from selling outputs in competition with the venture, in response to a price change by the venture.

C. APPLICATION TO PRIMESTAR

The Primestar direct broadcast satellite (DBS) venture is a good example of a vertically integrated joint venture. It also provides an illustration of the use of this methodology in the HSR review process and the

[68] This incentive effect arises from the standard "double marginalization" benefit that can occur from vertical integration. *See* Michael H. Riordan & Steven C. Salop, *Evaluating Vertical Mergers: A Post-Chicago Approach*, 63 ANTITRUST L.J. 513 (1995); David Reiffen & Michael Vita, *Is There New Thinking on Vertical Integration? A Comment*, 63 ANTITRUST L.J. 917 (1995).

type of controversies it can engender. Primestar is a joint venture that distributes cable programming services to consumers with home satellite dishes that receive DBS service. The owners of Primestar include a number of major cable operators, Time Warner, TCI, MediaOne, Cox, and Comcast, along with GE, the owner of the satellite on which Primestar broadcasts its signal. Primestar is a horizontal joint venture because DBS service competes with cable companies to distribute cable programming.

Primestar also involves vertical elements, however. The cable operators that own Primestar are integrated into program services, as well as cable distribution. For example, Time Warner owns program services, such as HBO, Cinemax, CNN, and TBS. Through Liberty Media, TCI has complete or partial ownership interests in program services, such as Encore and Discovery Channel.

The incentives analysis discussed in this article is relevant to the Federal Communications Commission and Department of Justice antitrust investigation of Primestar's proposed acquisition of the high-powered DBS capacity from News Corporation and MCI. The Justice Department expressed concern that this transaction would reduce competition between cable and DBS.[69] Primestar's economists used the quantitative methodology explained in the next Part of this article to demonstrate that the vertical effect (called the "programming effect" in the proceeding because it involved the sale of programming services to DBS and cable distributors) outweighed the horizontal effect (called the "cannibalization effect" by DirecTV's economist, Carl Shapiro, because it involved the fact that DBS diverted subscribers from cable).[70] The programming effect thus is a type of competitive or efficiency benefit from the vertical structure of the venture that leads to more competitive pricing incentives. As a result of the programming effect and Primestar's inherent cost advantages over a stand-alone entrant, Primestar's economists concluded from their analysis that even if one assumed that Primestar acted in the interests of its parents (i.e., even if Primestar was governed by Coasian joint control), Primestar's competitive incentives would not fall short of the competitive incentives of a hypothetical stand-alone DBS entrant.[71]

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[69] *See* Complaint, United States v. Primestar, Inc. No. 1:98CV01193 (JLG) (D.D.C. May 12, 1998) <http://www.usdoj.gov>.

[70] The authors were part of the Charles River Associates group that carried out this economic analysis on behalf of Primestar.

[71] Steven C. Salop et al., An Economic Analysis of Primestar's Competitive Behavior and Incentives (FCC Submission) (Jan. 7, 1998); Shapiro, Statement of Professor Carl Shapiro (FCC Submission) (Oct. 20, 1997). As part of its analysis, CRA also quantified Primestar's inherent cost advantages over the hypothetical stand-alone entrant. Such cost advantages also would intensify its incentives to reduce prices. CRA estimated the impact on incentives from Primestar cost advantages arising from volume discounts. *See* Gregory Rosston, Decla-

In a recent article, Daniel Rubinfeld (formerly Deputy Assistant Attorney General for Economics and head of the U.S. Department of Justice Antitrust Division's economic investigation of Primestar) reached the opposite conclusion.[72] Professor Rubinfeld's results differ from that of Primestar's economists because he makes a number of different assumptions. This controversy among the economists illustrates the types of issues that become salient when the methodology discussed in this article is used in the HSR process.

The main difference among the economists involves the Primestar economists' assumption that if Primestar reduced its price by a small amount, it would attract new subscribers from three sources—other DBS operators, cable operators, and over-the-air broadcast—in equal proportions. By contrast, Professor Rubinfeld observes that while DBS subscribers historically have come mainly from over-the-air television, that fact is changing as DBS matures. In the future, analysts expect that most DBS subscribers will switch from cable to DBS. Therefore, he concludes that it is appropriate to assume that most of Primestar's incremental subscribers in response to a price decrease also will come from cable.

Primestar's economists criticized the assumption that the diversion ratio equals the historical fraction of DBS subscribers that previously took cable. Suppose it were true that every DBS subscriber previously had taken cable. However, that is not the appropriate data. Many of the additional subscribers that it would attract by its price cut would be cable subscribers that otherwise would have switched from cable to a different DBS operator (i.e., DirecTV or Echostar) if Primestar had not reduced its price. In calculating the diversion ratio, those incremental subscribers are properly viewed as coming from other DBS operators, not from cable. Stated another way, cable subscribers will decide to switch to DBS. However, which DBS service they choose will depend on the relative prices of the DBS competitors.

Professor Rubinfeld also applied the median voter analysis to the Primestar joint venture. Using voting shares to determine the median shareholder, he argued that TCI would be the median shareholder and that TCI's incentives would tilt more towards fear of cannibalization than

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ration on Behalf of Echostar Communications (FCC Submission) (Oct. 20, 1997); Salop et al., A Further Analysis of the Effects of Cable Diversion, Premium Service Buy Rates, and Volume Discounts on Primestar's Competitive Incentives: A Response to Dr. Rosston (May 19, 1998); Salop et al., A Comparison of Primestar's Costs with Those of a Standalone Entrant (Mar. 31, 1998).

[72] Daniel L. Rubinfeld, *The Primestar Acquisition of the News Corp./MCI Direct Broadcast Satellite Assets*, REV. INDUS. ORG. (forthcoming 2000).

towards a desire for greater programming profits. However, Professor Rubinfeld's analysis does not take into account the various criticisms of the median voter analysis discussed in this article.

First, it is not clear that Professor Rubinfeld's assumption of total control by the median voter makes sense. If the Primestar partnership were to restrict its output to benefit its parents' cable operations, the costs and benefits would not be distributed uniformly among the parents. Side payments among the parents might be necessary in order to ensure the stability of the agreement. This analysis would suggest that the Coasian joint control scenario might be more appropriate than the total control assumption.

The fiduciary obligation scenario might be more likely. In fact, Primestar changed its corporate governance structure from a partnership to a corporation as part of the transaction to acquire the DBS slot. Its explicit rationale for this change was to eliminate the awkwardness and stalemates that regularly arose while it was a partnership. As a corporation, there are independent outside directors and fiduciary obligations that prevent vetoes by individual partners, as discussed above. Managers and directors would be constrained to act solely in the interest of Primestar, not its parents, because of fiduciary obligations arising under corporate and securities laws, disclosures required under the securities laws, and Primestar's corporate governance structure.[73]

Second, even if the median shareholder analysis were used, there is controversy over the identity of the controlling shareholder. Professor Rubinfeld's analysis is based on shareholder voting shares rather than decision making by the Board of Directors. However, because of the way in which Primestar Board membership was determined and the existence of public shareholders, a TCI appointee may not be the median voter on the Board. In contrast, Primestar's economists found that MediaOne would be the median Board member.[74] And, MediaOne's pricing incen-

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[73] TSAT and Primestar Application for Transfer of Control of TEMPO Satellite, Inc. (FCC Filing 91-SAT-TC-97). Rubinfeld's analysis also bases the determination of the median voter solely on analysis of pricing incentives. If other important related competitive decisions also were taken into account, for example, the identity and type of programming to carry, then the likelihood of there being a stable median shareholder with an ability to command a stable coalition is lessened considerably.

[74] Board seats were allocated as follows: TCI (3), Time Warner (3), MediaOne (1), Cox (1), Comcast (1), and public directors (2). Assuming that the public directors would vote in the interest of Primestar as a stand-alone entity, the resulting price rankings of these voters (from lowest to highest price) would be Time Warner (3), public directors (2), MediaOne (1), Cox (1), Comcast (1), and TCI (3). Thus, MediaOne is the median. If Primestar cost advantages over a stand-alone entrant are ignored, MediaOne preferences are slightly tilted towards fear of cannibalization. However, the preference is small (i.e.,

tives would not be significantly inferior to those of a stand-alone owner of Primestar.

V. QUANTITATIVE ANALYSIS OF COMPETITIVE INCENTIVES

Our analysis so far has been qualitative. It has developed an economic framework for evaluating the effect of partial ownership interests on competitive incentives. In this Part, we examine possible methods of quantifying these effects.[75] As discussed in the Introduction, Areeda and Turner were skeptical about the ability to quantify these effects.[76] Although we do not conclude that there is a unique index, we develop a number of useful methods and indices similar to ones used in merger analysis.

Antitrust economics has developed two technical methodologies for gauging quantitatively the effects of mergers on pricing and output incentives. One methodology, the HHI, has been used in the Horizontal Merger Guidelines since the 1982 version. In terms of the underlying economics, that methodology is premised on the Cournot oligopoly model of quantity competition among firms producing homogeneous products. More recently, a new methodology has been developed based on work by Carl Shapiro and others that uses the diversion ratio.[77] In economic terms, this methodology is premised on the Bertrand model of price competition among firms producing differentiated products.

In this section, we describe extensions of these methodologies for evaluating partial ownership acquisitions. The extension of the HHI is the modified HHI (or MHHI), which was developed in an earlier work.[78] This article extends the MHHI to a broader range of corporate control scenarios. We also develop the Price Pressure Index (or PPI), which extends the diversion ratio methodology for the Bertrand differentiated products model.

A. THE MODIFIED HERFINDAHL-HIRSCHMAN INDEX

The HHI index of concentration is used in antitrust as a rough screen for gauging the effect of a merger on competitive incentives. Although

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far less than 5%) and even a small Primestar cost advantage would reverse the direction of the preference.

[75] Some of the analysis in this Part is more technical. Readers may skip the technical portions without a significant loss. Indeed, this part does not introduce any new arguments, but rather quantifies the previous arguments.

[76] *See supra* text accompanying note 11.

[77] *See, e.g.*, the articles cited *supra* note 13.

[78] Bresnahan & Salop, *supra* note 5.

the HHI sometimes is treated as an arbitrary measure of concentration, it has a theoretical underpinning in industrial organization economics. In the Cournot oligopoly model of quantity competition among firms producing homogeneous products and protected by entry barriers, the HHI is related to the margin between the market price and cost.[79] That Cournot model can be extended to take into account partial ownership interests under different assumptions regarding corporate control. Following that methodology, Bresnahan and Salop modified the HHI for a different set of alternative financial interest and corporate control scenarios.[80] The revised MHHIs, summarized in Table 1 below, cover a broader range of scenarios.[81] The MHHI can be taken as a rough gauge of these partial ownership scenarios on competitive incentives.

The first column of Table 1 below gives the formulas for the MHHI increases. The MHHI increases (the "deltas") are caused by a partial ownership transaction in which firm *A* obtains a financial interest in firm *B* that entitles it to a fraction Beta (β) of the profits of firm *B* and the two firms have pre-acquisition market shares of S_a and S_b respectively. The right-hand side gives the results for an acquisition of a 20 percent financial interest in firm *B*, when firm *A* has a market share of 20 percent and firm *B* has a market share of 10 percent.

Table 1 reflects the analysis discussed previously. A larger financial interest leads to a greater reduction in the competitive incentives of firm *A*. In addition, the effect of the transaction on the competitive incentives of firm *B* depends crucially on the structure of corporate control. The

Table 1
Modified HHI Deltas

	General Formula	*Results from Example*
Full Merger:	$\Delta = 2S_aS_b$	400
Silent Financial Interest:	$\Delta = \beta\ S_aS_b$	40
Total Control:	$\Delta = (\beta + 1/\beta)\ S_aS_b$	1040
One-way Control:	$\Delta = (1 + \beta)\ S_aS_b$	240
Coasian Joint Control:	$\Delta = 2S_aS_b$	400
Proportional Control:	$\Delta = (\beta + \beta/((1 - \beta)^2 + \beta^2))\ S_aS_b$	99

[79] In particular, the HHI is the share-weighted average of the price-cost margin in the industry multiplied by the aggregate demand elasticity in the industry.

[80] Bresnahan & Salop, *supra* note 5.

[81] Table 1 contains a number of the scenarios derived by Bresnahan & Salop, *id.*, and some additional scenarios that we have derived for this article. The formulas used to derive each scenario are presented in the Appendix.

MHHI delta is lowest for a silent financial interest because the acquisition has no effect on the incentives of firm *B*. The MHHI delta is largest for the case of total control, reflecting the adverse effect on incentives from the free-rider effect. Full merger, one way control and proportional control are in the middle. When firm *A* has a 100 percent financial interest in firm *B* (i.e., $\beta = 1$), all the scenarios except silent financial interest converge to the full merger result of $\Delta = 2S_aS_b$. The MHHI delta does not converge to $2S_aS_b$ under silent financial interest because that scenario maintains the assumption that firm *B*'s incentives are not affected even when firm *A* has an interest as high as 100 percent. This assumption, of course, is implausible in this limiting case because a firm with a 100 percent interest clearly would have control.

By comparing the numbers in the example, the dramatic effect of alternative governance structures can be illustrated. For example, silent financial interest gives a delta of 40, in contrast to a full merger delta of 400. This indicates that a presumption that silent financial interest has incentive effects close to those of a merger can be extremely inaccurate. Indeed, even if the financial interest share was 50 percent, the MHHI delta would be one-quarter of the value of a full merger. The one-way control scenario also is significantly different from a full merger; the delta is only 240, only slightly more than half the increase from a merger. In the example, the incentive effects of total control by a minority shareholder are far worse than a merger. With a financial interest share of 20 percent, total control leads to an MHHI delta of 1040, in contrast to a merger delta of 400.

We previously explained why the incentive effects of total control become more adverse as the financial interest share becomes lower. In Table 1, the smaller the financial interest in the acquired firm, the larger is the MHHI delta. For example, a financial interest of 20 percent leads to an MHHI delta of 1040. If the financial interest share instead were 50 percent, the MHHI delta would fall to 500.[82] Finally, as the financial interest share (β) approaches zero, the adverse incentive effects become unbounded.

The formulas for the increases in the MHHI in Table 1 can be used to evaluate the competitive effects of partial ownership acquisitions in the same way that the increases in the HHI are used in merger analysis. That is, the MHHI calculations provide a rough estimate of the effect of the change in ownership structure. Of course, MHHI calculations, just like conventional HHI calculations, are very rough in that they

[82] That is, $2.5 \times S_aS_b$.

assume a relevant market that entails no substitution to products outside the market, prohibitive entry barriers, no other competitive effects factors, and no efficiency benefits. However, the calculations can be useful as a first step, just as is the HHI in merger analysis.[83]

The MHHI applies to the situation in which a single firm has a partial ownership interest in a single competitor. However, this methodology and the resulting MHHIs can be expanded for joint ventures in which multiple firms have partial ownership interests. In that case, there will be a similar component of the MHHI delta for each partial ownership interest, and these are aggregated to an overall delta.[84] Similarly, if a market is structured with multiple joint ventures, either with distinct owners for the different ventures or with some or all of the owners having financial interests in multiple ventures, the MHHI also can be applied.

In the Appendix, we derive a general formula for the MHHI that applies to an arbitrary array of partial ownership interests. Suppose β_{ij} is the fraction of firm j that is owned by owner i, and γ_{ij} is the weight that that manager of firm j places on owner i's profits in calculating the profits of firm j (i.e., γ_{ij} reflects the degree of control that owner i has over firm j). The market share of firm j is s_j. We show in the Appendix that the MHHI can be expressed by the following equation:

$$(1) \qquad MHHI = HHI + \sum_{j}\sum_{k\neq j}\left(\frac{\sum_{i}\gamma_{ij}\beta_{ik}}{\sum_{i}\gamma_{ij}\beta_{ij}}\right)s_k s_j .$$

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[83] The change in the HHI is a rough measure of the change in competitive incentives flowing from a horizontal merger. Farrell and Shapiro show that the premerger HHI and the increase in the HHI (the "delta") calculated using premerger market shares are imperfect measures of the market price and output after a merger. One problem is that the use of premerger shares in the index likely overstates the merging firm's share in the event that it takes an anticompetitive action. A second problem is that there are circumstances in which an increase in the HHI can be associated with an increase in output. These imperfections, which are well known, are present in the MHHI as well as the HHI. *See* Joseph Farrell & Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis*, 80 AM. ECON. REV. 107 (1990). A useful discussion of the issues surrounding use of the HHI is also contained in Ordover & Shapiro, *supra* note 5.

[84] For example, suppose that firms *A*, *B*, and *C* are competitors, and that *C* is a joint venture in which *A* owns 10%, *B* owns 20%, and public shareholders own the remainder. Suppose further that *A*'s market share is 30%, *B*'s share is 50%, and *C*'s share is 20%. If the financial interests of *A* and *B* are silent, there are two MHHI delta components associated with the two interests. The delta associated with *A*'s interest is $\Delta_A = 60$ ($= 0.1 \times 30 \times 20$), and the delta associated with *B*'s financial interest is $\Delta_B = 200$ ($= 0.2 \times 20 \times 50$). The total delta associated with the interests of firms *A* and *B* in the joint venture *C* (as compared to a situation where independent owners operated firm *C*) is the sum, or 260. The deltas for the alternative control scenarios can be computed using the formulas in equation 1, *infra*.

Therefore, the MHHI is the standard HHI on the assumption that all the firms are independent plus the various deltas (the terms under the summation) that arise from partial ownership interests. All the MHHI delta calculations in Table 1 are derived from this general expression under the appropriate assumptions about the amount of control conferred by partial ownership.

B. THE PRICE PRESSURE INDEX

Antitrust economists recently have focused in more detail on analyzing the effects of mergers on unilateral pricing incentives among firms selling differentiated products.[85] These analyses are based on the Bertrand oligopoly model with differentiated products. That model does not generate a unique, simple estimate of the change in incentives like the HHI.[86] However, Carl Shapiro has shown how the model can be manipulated to get a rough estimate of the change in unilateral incentives based on a number of potentially measurable factors.[87] A number of alternative indicators of these incentive effects can be derived. We refer to these indicators as indices of pricing pressure, to capture the idea that they measure the economic pressure to change prices in response to a change in ownership structures. We refer to each of the resulting measures as a Price Pressure Index, or PPI. Alternative PPI measures for mergers can be derived according to the stage of the competitive adjustment process at which the calculation is made. In this article, we focus on the simplest stage, the direct incentive effects of the financial interest, holding the prices of all rival firms constant.[88]

The formal derivation of the PPI deltas for each of the control scenarios is contained in the Appendix below. Table 2 summarizes the results.

The formulas for the PPI deltas are caused by a partial ownership transaction in which firm A obtains a financial interest in firm B that entitles it to a fraction Beta (β) of the profits of firm B and the fraction of sales lost by firm A that are diverted to firm B is denoted by δ_{ba}. The

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[85] *See, e.g.*, 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); Shapiro, *supra* note 13.

[86] In fact, one of the motivations for these newer approaches is dissatisfaction with the HHI as an index for measuring the competitive effects of mergers between producers of differentiated products.

[87] Shapiro, *supra* note 13.

[88] This particular PPI may overstate the anticompetitive effect because it fails to account for the fact that demand often becomes more elastic as price increases. We have analyzed a PPI that takes into account the impact on demand elasticity and that is based on a complete adjustment to a new post-acquisition equilibrium. The overstatement also can be adjusted by use of an appropriate benchmark.

Table 2
Modified PPI Deltas

	ΔPPI_a	ΔPPI_b
Full Merger:	$\delta_{ba}\,(P_b - C_b)/C_a$	$\delta_{ab}\,(P_a - C_a)/C_b$
Silent Financial Interest:	$\beta\,\delta_{ba}\,(P_b - C_b)/C_a$	0
Total Control:	$\beta\,\delta_{ba}\,(P_b - C_b)/C_a$	$(1/\beta)\,\delta_{ab}\,(P_a - C_a)/C_b$
One-way Control:	$\beta\,\delta_{ba}\,(P_b - C_b)/C_a$	$\delta_{ab}\,(P_a - C_a)/C_b$
Coasian Joint Control:	$\delta_{ba}\,(P_b - C_b)/C_a$	$\delta_{ab}\,(P_a - C_a)/C_b$
Proportional Control:	$\beta\,\delta_{ba}\,(P_b - C_b)/C_a$	$[\beta/((1-\beta)^2 + \beta^2)]\,\delta_{ab}\,(P_a - C_a)/C_b$

MHHI and PPI formulas have certain similarities. In particular, if the two firms are symmetric, with identical prices, costs, and diversion ratios, then the two PPI terms can be added up. In that case, the ownership and control parameters (i.e., the β- terms) enter the summed equation in much the same way as in the MHHI. Unlike the MHHI analysis, however, there is a separate delta for each firm, and the deltas depend on measures of the firms' margins relative to marginal cost [$(P_b - C_b)/C_a$ and $(P_a - C_a)/C_b$ respectively] and diversion ratios (δ_{ba} and δ_{ab} respectively) rather than market shares alone. The pressure to increase price following the merger depends on the reduction in the opportunity cost of raising price, which depends on margins and diversion ratios. The larger is firm B's margin $(P_b - C_b)$ relative to firm A's marginal cost C_a, the greater is the profit recaptured by firm A on sales diverted to firm B, and hence the greater is the reduction in the opportunity cost to firm A of raising price. Similarly, the larger is the diversion ratio δ_{ba} from firm A to firm B, the greater is the profit recaptured by firm A on sales diverted to firm B, and the greater is the reduction in the opportunity cost to firm A of raising price. Thus, other things equal, the incentive for firm A to raise price after the merger is larger the higher is firm B's margin and the diversion ratio from firm A to firm B. Firm B's incentives are analyzed in a similar way.

As with the MHHI, the PPIs can be expanded for the case of joint ventures in which multiple firms have partial ownership interests and markets with multiple joint ventures. Suppose β_{ij} is the fraction of firm j that is owned by owner i, and γ_{ij} is the weight that that manager of firm j places on owner i's profits in calculating the profits of firm j. Starting from a position of no partial ownership interests, we show in the Appendix that the PPI delta for firm j can be written in general form as

$$\Delta PPI_j = \sum_{k \neq j} \frac{\sum_i \gamma_{ij}\beta_{ik}}{\sum_i \gamma_{ij}\beta_{ij}} \delta_{kj} \frac{P_k - C'_k}{C'_j}. \tag{2}$$

The formulas for the PPI in Table 2 are special cases of the expression in equation (2).

1. *Expanding the PPI Analysis*

We discuss two ways to expand the PPI incentives analysis. First, efficiency benefits created by the acquisition can be included in the index. Second, the index can be combined with simulation techniques to obtain indices that reflect market-wide pricing interactions that occur after the transaction.

a. Efficiency Benefits

Joint ventures potentially can lead to a variety of efficiency benefits.[89] These potential benefits include lower costs and superior products from synergies created by integrating the parents' technologies, intellectual property rights, and know-how. Joint ventures also can lead to elimination of duplicative costs and efforts and efficient risk sharing.

One of the advantages of the PPI approach over the MHHI approach is its ability to incorporate efficiency benefits into the analysis in a simple way. It is straightforward to include cost reductions into the derivation of the ΔPPI. If a merger, partial ownership acquisition, or joint venture leads to lower costs for any of the firms, the lower costs lead to more competitive pricing incentives, other things held constant. These incentives can be added to the incentive effects from the cross-ownership itself. When marginal costs are decreased, they can offset some or all of the adverse competitive effects of the cross-ownership. If the cost reduction is large enough, the efficiency benefits can dominate the adverse incentive effects, so that the acquisition actually increases the competitiveness of the firm's unilateral pricing incentives. In that case, the net impact of the acquisition might be to reduce prices.

The incorporation of cost reductions into the analysis is easy to see in equation (3). That expression shows how the change in firm *A's* pricing incentives depends on the change in its marginal costs and the incentive effects of its financial interests. If the transaction reduces firm *A's* costs, that component leads to an incentive for it to reduce its price.[90] In terms

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[89] *See, e.g.*, Carlton & Salop, *supra* note 60; Carl Shapiro & Robert D. Willig, *On the Antitrust Treatment of Production Joint Ventures*, 4 J. ECON. PERSP., Summer 1990, at 113.

[90] The amount of the cost reduction that is passed on to purchasers depends on the shape of the demand curve. For example, linear demand results in 50% of cost savings being passed on, semi-log demand of the form $ln(q) = a - bp$ results in 100% pass-through, and constant elasticity demand results in more than 100% pass-through. Since the shape of the demand curve is hard to measure, the amount of pass-through can be hard to predict (though it can sometimes be estimated econometrically). However, the size of the

of the ΔPPI, if marginal costs are reduced by an amount ΔC, and the incentive effects of its financial interests are X_a, then the ΔPPI reflects these changes as

$$\Delta PPI_a = \frac{\Delta C_a + X_a}{C_a} \quad (3)$$

With this methodology, only cost reductions that affect marginal costs will lead to potential price decreases. To the extent that a transaction leads solely to reductions in fixed costs, those cost reductions will not affect pricing in the short run, according to standard industrial organization methodology. They may affect prices in the long run by leading to entry or by deterring exit or by lowering long-run marginal costs. However, those effects do not enter this short-run pricing incentives analysis in the simple way set out here.[91]

It is also worth noting that not all marginal cost reductions are treated as cognizable under the standards articulated in the efficiency section of the Merger Guidelines.[92] In particular, cost reductions that do not represent real resource savings, but rather are transfers from one group to another, may not be counted. Tax reductions and lower input prices arising from increased bargaining power with suppliers are two important examples.

Efficiency benefits that take the form of superior product quality in principle can be added to the balance by estimating the cost-reduction equivalent (for the old product) of the quality increase. These quality improvements are the equivalent of marginal cost reductions because they affect each (marginal) unit produced.

b. The Impact of Market-wide Pricing Interactions

As we mentioned earlier, the PPI delta measures the pressure to raise price, holding rivals' prices constant. An alternative measure of incentives would examine the full equilibrium effects of changes in partial ownership, allowing competitors' prices to adjust in the new equilibrium. This methodology involves oligopoly simulation analysis, a technique that

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anticompetitive incentive effect $\beta\ \delta_b\ (P_b - C_b)/C_a$ relative to the cost savings $\Delta C/C_a$ is likely to be easier to estimate.

[91] Gary L. Roberts & Steven C. Salop, *Dynamic Analysis of Efficiency Benefits in Mergers*, WORLD COMPETITION L. & ECON. REV. 5 (1996).

[92] *See* Horizontal Merger Guidelines, *supra* note 1, § 4. For a further discussion of the relationship between the antitrust economic welfare standard and the treatment of different types of cost reductions, see Roberts & Salop, *supra* note 91.

recently has generated substantial research and some use in merger analysis at the antitrust agencies.[93]

While the simulation approach provides a potentially more accurate measure of the ultimate price effects, the simpler PPI delta described here is still highly useful and may be a better tool in some cases. First, the PPI delta requires less information and is much simpler to calculate than the industry-wide, "equilibrium" price effects of an acquisition. Second, the PPI delta is readily interpreted as equivalent to a specific change in the marginal cost of each of the firms affected by a change in ownership structure. Third, while the PPI delta does not account explicitly for the price changes of all firms in the post-acquisition equilibrium, it provides a good measure of the size of the direct incentives of the firms involved in the transaction. The greater the incentive to raise price suggested by the PPI delta, for example, the greater the price increase expected from the acquisition, other things being equal. Finally, while the PPI delta is not perfect, it is calculated directly from the factors that affect pricing incentives. Thus, it will generally do a much better job of predicting the price effects of acquisitions in differentiated product settings than measures of market concentration like market shares or HHI (or MHHI) deltas.

VI. CONCLUSION

In this article, we have described an economic framework for analyzing the competitive effects of partial ownership interests and joint ventures. We have shown that the economic effects of partial ownership have some similarities with the effects of complete mergers. However, an additional element raised by partial ownership is that financial interest can involve varying degrees of corporate control. We showed that financial interest and corporate control are separate and distinct elements in the competitive effects of partial ownership. Unlike merger analysis, where the acquiring firm automatically controls the acquired entity after the merger, the analysis of partial ownership involves a careful assessment of the degree of corporate control conferred by the ownership interest.

In their treatise, Areeda and Turner conclude that, unlike a complete merger, a "noncontrolling acquisition has no intrinsic threat to competition at all."[94] Our analysis demonstrates that this conclusion is incorrect.

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[93] Werden & Froeb, *supra* note 85; Shapiro, *supra* note 13; Jonathan B. Baker, *Unilateral Competitive Effects Theories in Merger Analysis*, ANTITRUST, Spring 1997, at 21; Gregory J. Werden, *Simulating Unilateral Competitive Effects from Differentiated Products Mergers*, ANTITRUST, Spring 1997, at 27.

[94] *See* 5 AREEDA & TURNER, *supra* note 9, at 322.

We have explained how a partial financial interest changes the acquiring firm's incentives, even when the firm will have no control over the acquired firm's actions. In a horizontal acquisition, its incentives may change in an anticompetitive way, while in a vertical acquisition, its incentives may well change in a way that is beneficial.

We have also shown that the Areeda and Turner view that "there is no formula that can describe the likelihood of [anticompetitive effects from partial ownership]" is overly pessimistic.[95] We have set out quantitative frameworks (the MHHI and PPI deltas) that are consistent with the methodology used today in merger analysis (HHIs and the diversion ratio approach), but general enough to account for the separate and distinct elements of financial interest and corporate control in partial ownership interests. We think that this can be a useful addition to the toolkit of merger and partial ownership analysis.

[95] *Id.*

APPENDIX

A. Numerical Example of the Price Effects of Merger and Partial Ownership

This Appendix develops a complete numerical example to show why a silent partial ownership interest has a smaller effect on the price set by the acquiring firm than would a complete merger. In fact, for the special case of the linear demand, used in this example considered here, a partial ownership interest of x% yields a direct effect on the acquiring firm's price of x% of the effect caused by a complete merger.

We assume that two firms, labeled 1 and 2, sell differentiated products in competition with one another. The demand for firm-1's product is

$$D_1(P_1,P_2) = 56 - .8P_1 + .4P_2.$$

Firm-2's demand has the same cross effect as that for firm-1, i.e., a $10 increase in the price of good 2 increases the demand for good 1 by 4 units (and vice versa). Prior to merging, firm-1 maximizes its profits $\pi_1 = (P_1 - c_1)D_1(P_1,P_2)$. The first-order condition for project-maximization is

$$D_1 + (P_1 - c_1)\frac{\partial D_1}{\partial P_1} = 0. \tag{A1}$$

Multiplying by P_1/D_1 and solving for P_1 yields

$$P_1 = \frac{e_{11}}{e_{11} - 1}\, c_1 \tag{A2}$$

where e_{11} is the absolute value of the own elasticity of demand for product 1, $e_{11} = -(\partial D_1/\partial P_1)P_1/D_1 = .8P_1/(56 - .8P_1 + .4P_2)$. Suppose that $c_1 = 80$ and $P_2 = 100$. Substituting these values along with the expression for e_{11} into equation (A2) and solving yields a premerger price of $P_1 = 100$.

Now suppose that firm-1 merges with firm-2. The merged firm chooses P_1 to maximize the joint profits $\pi^M{}_1 = (P_1 - c_1)D_1(P_1,P_2) + (P_2 - c_2)D_2(P_1,P_2)$. The first order condition now is

$$D_1 + (P_1 - c_1)\frac{\partial D_1}{\partial P_1} + m_2\frac{\partial D_2}{\partial P_1} = 0 \tag{A3}$$

where m_2 is the (absolute) margin $P_2 - c_2$ of firm-2. Dividing through by $\partial D_1/\partial P_1$, multiplying the first term by P_1/P_1 to convert it into an elasticity, and solving for P_1 yields the post-merger price

$$P_1 = \frac{e_{11}}{e_{11} - 1}\left[c_1 + m_2\delta_{21}\right]. \tag{A4}$$

where δ_{21} is the diversion ratio from firm-1 to firm-2, that is, the fraction of sales lost by firm-1 that are captured by firm-2. Suppose that the diversion ratio from firm-1 to firm-2 is 50%, i.e., a 10% price increase causes 50% of the customers that substitute away from firm-1 to switch to firm-2. Assume further that $P_2 = 100$, $m_2 = 100 - 60 = 40$, and $c_1 = 80$. Substituting these values along with the expression for e_{11} into equation (A4) and solving for P_2 yields a postmerger price of $110.

Alternatively, suppose that firm-1 purchases a partial ownership interest of 25% in firm-2. The profit objective of the manager of firm-1 is now $\pi^P_1 = (P_1 - c_1)D_1(P_1,P_2) + .25(P_2 - c_2)D_2(P_1,P_2)$. It is straightforward to show that the profit-maximizing price for firm-1 in light of the partial ownership interest must satisfy

$$P_1 = \frac{e_{11}}{e_{11} - 1}\left[c_1 + .25\ m_2\delta_{21}\right] \tag{A5}$$

Note that equation (A5) is the same as equation (A4) except that the margin-diversion ratio term in brackets is multiplied by firm-1's ownership share in firm-2.

Solving equation (A5) for the optimal price under the same assumptions as above yields $P_1 = 102.5$. Thus, while a complete merger gives firm-1 an incentive to raise price by 10%, a partial ownership interest of 25% gives it an incentive to raise price by only 2.5%, or one-fourth the incentive that exists in a complete merger. The result that an x% partial ownership interest yields a direct price effect of x% of the price effect caused by a complete merger is not general, but rather is an artifact of the linear demand assumption made in this example.

B. DEVELOPMENT AND EXPLANATION OF THE PPI

To develop the PPI, consider a market comprised of a number of firms selling differentiated products. To focus on situations where there is a potential for anticompetitive effects, suppose that further entry is impossible. Suppose further that the firms do not tacitly collude in their pricing decisions.[1] Instead, suppose that each firm follows the Bertrand

[1] Tacit collusion can arise when firms' pricing decisions depend on past pricing behavior by their rivals. For example, a firm may raise price (or refrain from lowering price) if it

oligopoly model and prices unilaterally, taking the prices of rivals as fixed and ignoring the potential effect of its pricing on the prices chosen by its rivals. In this scenario, the firms will reach a pricing outcome in which prices typically exceed the perfectly competitive level. A firm's price will exceed its marginal cost by an amount that depends on its elasticity of demand, that is, the sensitivity of its demand to the price it charges.

Given this structure, suppose that the sole (i.e., 100%) owner of one firm (call it firm-*A*) acquires a partial financial interest in another firm (call it firm-*B*) that entitles it to a fraction Beta (β) of firm-*B's* profits. After the transaction, firm-*A's* owner will collect all the profits π_a earned by firm-*A* and a fraction β of the profits π_b earned by firm-*B*. Thus, the owner's total return π will be

(B1) $$\pi = \pi_a + \beta\pi_b$$

This financial interest will alter firm-*A's* unilateral pricing incentives in the way described previously. Assuming that the prices of firm-*B* and the other competitors are viewed by firm-*A* as constant at the pre-acquisition level, firm-*A* will experience pressure to increase its price as a result of this change in incentives. The resulting pricing pressure can be derived and quantified by a formula that computes the effect of a price increase on firm-*A's* profits with and without the financial interest.

Absent any ownership interest in firm-*B*, firm-*A's* profit-maximizing price represents a mark-up of its marginal costs, where the mark-up over costs depends on firm-*A's* elasticity of demand. We can write this relationship as

(B2) $$P_a = M_a C_a$$

where M_a is the mark-up factor that depends on firm-*A*'s own-elasticity of demand.[2] This factor is greater than one, which means that the profit-maximizing price exceeds marginal cost. The lower is the own elasticity, the greater is the mark-up factor, and greater is the mark-up of price over marginal cost.

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fears that a lower price would cause its rivals to start a price war. Similarly, a firm may perceive a price increase that is retracted when it is not followed as a signal that it should follow the price increase to avoid a price war. In this article, we assume that the recognition of this type of interdependence is absent. That is, we focus on unilateral effects.

[2] Specifically where $M_a = \frac{e_{aa}}{e_{aa} - 1}$ where e_{aa} is the absolute value of firm-*A*'s own-elasticity of demand, as in Equation (A2).

We have previously explained that when firm-*A* acquires a financial interest share β in firm-*B*, firm-*A's* profit-maximizing price rises to take account of the change in unilateral pricing incentives. In this case, the pricing relationship becomes:

(B3) $$P_a = M_a \{C_a + X_a\}$$

where X_a measures the effect of firm-*A's* cross ownership of firm-*B*.

The financial interest in firm-*B* has the same effect on firm-*A's* optimal price as would an increase in its costs. This result makes intuitive sense. The financial interest in firm-*B* generates an "opportunity cost" to firm-*A* of increasing its output. If firm-*A* reduces its price to sell more of its product, that lower price will divert customers away from firm-*B* and reduce firm-*B's* profits accordingly. As a result, the owner of firm-*A* will get a smaller return on that investment in firm-*B*.

The cross-ownership opportunity cost (X_a) measures the reduction in firm-*A's* profit on its investment in firm-*B* from increasing its sales by one unit. The magnitude of this cross-ownership effect is the product of three factors that determine the impact of a lower firm-*A* price on the returns on its investment in firm-*B*. These factors are firm-*A's* share of firm-*B's* profits (β), the margin of price over cost earned by firm-*B* on each unit sold ($P_b - C_b$), and the fraction of extra firm-*A* sales that are diverted to firm-*B* (δ_{ba}), that is, the *diversion ratio*.[3] The diversion ratio measures the degree to which firm-*B's* product is a close substitute for firm-*A's* product.[4] The expression for the cross-ownership opportunity cost X_a is given as follows:

(B4) $$X_a = \beta\delta_{ba}(P_b - C_b)$$

We can use this cross-ownership opportunity cost to quantify the increased pricing pressure on firm-*A's* price induced by the financial interest. Assuming that firm-*B* and the other competitors do not change their prices, the percentage increase in firm-*A's* profit-maximizing price can be approximated from these equations. We call this approximate percentage price increase the PPI delta.

Using equation (B4), we have

(B5) $$\Delta PPI_a = \frac{X_a}{C_a} = \beta\delta_{ba}\frac{P_b - C_b}{C_a}$$

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[3] Shapiro, *supra* note 13.

[4] Formally, the diversion ratio is the ratio of the cross-elasticity of demand for firm-*B*'s product when firm-*A* raises price relative to the own-elasticity of demand for firm-*A*'s product times the ratio of the quantity of firm-*B* relative to the quantity of firm-*A*.

In principle, the ΔPPI_a can be measured from data collected during the investigation of a merger, partial ownership acquisition, or joint venture. For example, prices and estimates of marginal costs might be estimated by using the firms' profit and loss statements, and diversion ratios might be estimated from econometric demand analysis, customer switching studies, and second-choice surveys.

The impact of the transaction on firm-*B's* pricing incentives and the corresponding PPI_b delta can be derived in a similar fashion.[5] As discussed earlier, firm-*B's* unilateral pricing incentives depend on the corporate control scenario. For example, if firm-*A* has no control over firm-*B*, either because it obtains a silent financial interest or because of fiduciary obligations, then there is no effect on firm-*B's* unilateral pricing incentives. In this scenario, the PPI_b delta would equal zero.

In contrast, if firm-*A* has total control over firm-*B*, then it will have firm-*B* choose a price that maximizes firm-*A's* total returns, as given in equation (2). In this case, after the transaction, firm-*B* will choose a price P_b that reflects the interest of this controlling shareholder.[6] The resulting ΔPPI_b for this case is

(B6) $$\Delta PPI_b = \frac{X_b}{C_b} = \frac{1}{\beta}\delta_{ab}\frac{P_a - C_a}{C_b}$$

C. THE MODIFIED HHI AND PRICE PRESSURE INDICES

This Part of the Appendix provides additional details on the theoretical underpinnings of the MHHIs and PPIs and how they are calculated. For each index we present the economic model that allows one to measure the competitive effects of partial ownership under a variety of assumptions about the degree of influence owners have over the management of firms in which they have an interest. We first provide the notation used in the model; we then derive the general formulas for the two indices that are used to generate the formulas for the MHHI and PPI deltas and provide a further explanation for the indices.

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[5] In this case, firm-*B*'s pricing incentives and ΔPPI_b are derived under the assumption that firm-*A* and the other competitors do not alter their prices as a result of the acquisition. Of course, that assumption is false, which is part of why the ΔPPIs measure pricing *pressure* rather than the actual price effects that will flow from the acquisition. However, as discussed later, the pricing assumption can be relaxed and the ΔPPI's then can be combined to predict the resulting equilibrium price effects. Alternatively, the ΔPPIs can be compared to a benchmark.

[6] The assumption that the acquiring and acquired firms behave unilaterally becomes less plausible when the acquiring firm has substantial or total control. In this case the PPI delta may understate the pressure to increase price because it ignores the additional effects that may arise from collusion between the two firms.

1. *Notation*

We will use the following notation:

N firms ($j = 1, \ldots, N$)

M owners ($i = 1, \ldots, M$)

x_j: output of firm-j

$X = \sum_j x$: industry output (summations are taken over all possible values of the index whenever the domain of the index is omitted)

$s_j = x_j / X$: firm-j's market share

$C_j(x_j)$: cost of output level x_j

$P(X)$: inverse demand for X (Cournot model, MHHI)

$D_i(P_1, \ldots, P_N)$: demand for product i (Bertrand model, PPI)

$\pi_j = P(X)x_j - C(x_j)$: profits in Cournot model

$\pi_j = P_j D_j(P_1, \ldots, P_N) - C_j(D_j(P_1, \ldots, P_N))$: profits in Bertrand model

β_{ij}: ownership share of firm-j owned by owner-i

γ_{ij}: measure of owner-i's degree of control over firm-j

η: aggregate own-price elasticity of demand (absolute value)

$\pi^i = \sum_j \beta_{ij} \pi_i$: owner-$i$'s profit

$\Pi_j = \sum_i \gamma_{ij} \pi^i$: total profits maximized by the manager of firm-j

In a standard oligopoly model with no partial-ownership interests, the owners of the firm typically agree on the strategy that the manager of the firm should pursue—maximize the profits of the firm. Barring any market imperfections that preclude efficient contracting between the owners and the manager, the owners will give the manager the incentive to maximize the profits of the firm.

When multiple owners have partial-ownership interests, however, they may not agree on the best course of action for the firm. For example, an owner of firm-*A* who also has a large financial interest in a rival firm-*B* typically wants firm-*A* to pursue a less aggressive strategy than the strategy desired by an owner with no financial interest in firm-*B*. In this situation, where the owners have conflicting views on the best strategy to pursue, the question arises as to how the objective of the manager is determined. Ultimately, the answer turns on the corporate-control structure of the firm, which determines each shareholder's influence over decision-making within the firm.

A parsimonious way to model shareholder influence is to assume that the manager of the firm maximizes a weighted sum of the shareholder's returns. This formulation includes a wide variety of plausible assumptions about the amount of influence each owner has over the manager of the

firm. Under this formulation, a higher weight on the profit of a particular owner is associated with a greater degree of influence by that owner over the manager. Different control scenarios then correspond to different sets of "control weights" for the different owners.

2. *MHHI*

The MHHI, like the HHI, assumes that firms are Cournot competitors. Using the notation introduced above, the manager of firm-j solves

$$\max_{x_j} \Pi_j = \max_{x_j} \sum_i \gamma_{ij} \pi^i = \max_{x_j} \sum_i \gamma_{ij} \sum_k \beta_{ik} \pi_k = \max_{x_j} \sum_i \gamma_{ij} \sum_k \beta_{ik} [P(X) x_k - C_k(x_k)]$$

The first-order condition for an interior solution is

$$\sum_i \gamma_{ij} \left\{ \sum_k \beta_{ik} P' x_k + \beta_{ij} [P - C_j'(x_j)] \right\} = 0.$$

Multiplying through by X/X and 1/P, this condition can be rewritten as

$$\sum_i \gamma_{ij} \sum_k \beta_{ik} \left(\frac{P'X}{P} \right) \frac{x_k}{X} + \sum_i \gamma_{ij} \beta_{ij} \frac{P - C_j'(x_j)}{P} = 0,$$

which, after rearranging sums, becomes

$$\frac{P - C_j'(x_j)}{P} = \frac{1}{\eta} \sum_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_l \gamma_{ij} \beta_{ij}} s_k.$$

Multiplying both sides by s_j and summing over all j yields

$$\sum_j s_j \frac{P - C_j'(x_j)}{P} = \frac{1}{\eta} \left[\sum_k \sum_j \left(\frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \right) s_k s_j \right]. \tag{C1}$$

In the standard Cournot model with no partial ownership, the bracketed term in (C1) would equal HHI = $\sum_j s_j^2$. Thus, the HHI can be thought of as a measure of concentration constructed to be proportional to the share-weighted sum of the margins of all firms under Cournot competition. Using the same rule to construct a concentration index for the case of partial ownership, the MHHI is the bracketed term in (C1):

$$MHHI = \sum_k \sum_j \left(\frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \right) s_k s_j. \tag{C2}$$

By separating out the terms for which $k = j$, expression (2) can be written as

$$\text{(C3)} \qquad MHHI = HHI + \sum_j \sum_{k \neq j} \left(\frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \right) s_k s_j .$$

Thus, the MHHI is equal to the HHI plus a set of terms reflecting the competitive effects of cross-ownership within the industry. Starting from a position of zero partial ownership interests, the MHHI delta for a particular new ownership structure can be measured by the summation term in (C3).

3. *PPI*

The PPI similarly can be derived from the basic profit maximization calculus. The manager of firm-j solves

$$\Pi_j = \max_{P_j} \sum_i \gamma_{ij} \pi^i = \max_{P_j} \sum_i \gamma_{ij} \sum_k \beta_{ik} \pi_k = \max_{P_j} \sum_i \gamma_{ij} \sum_k \beta_{ik} [P_k D_k - C_k(D_k)].$$

The first order condition for an interior solution is

$$\sum_i \gamma_{ij} \beta_{ij} \left[D_j + (P_j - C_j') \frac{\partial D_j}{\partial P_j} \right] + \sum_{k \neq j} \sum_i \gamma_{ij} \beta_{ik} (P_k - C_j') \frac{\partial D_k}{\partial P_j} = 0.$$

Solving for P_j gives

$$\text{(C4)} \qquad P_j = \frac{-D_j}{\partial D_j / \partial P_j} + C_j' + \sum_{k \neq j} \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \delta_{kj} (P_k - C_k')$$

where and $\delta_{kj} = -(\partial D_k / \partial P_j) / (\partial D_j / \partial P_j)$ is the diversion ratio from product-j to product-k. Multiplying the second term on the right-hand side of (C4) by P_j / P_j to put the expression into elasticity form, and then solving for P_j gives

$$\text{(C5)} \qquad P_j = M_j \left[C_j' + \sum_{k \neq j} \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \delta_{kj} (P_j - C_k') \right]$$

where $M_j = (e_{jj} / (e_{jj} - 1))$ is the standard mark-up factor for firm-j, with $e_{jj} = -(\partial D_j / \partial P_j)(P_j / D_j)$ being the absolute value of firm-j's own-elasticity of demand. Starting from a position of no partial financial interests, the ratio of the summation terms in (C5) relative to the marginal cost is the PPI delta.

4. *Interpretation of the MHHIs and PPIs*

Starting from a position of zero cross-ownership, the MHHI delta can be rewritten from (C3) as:

$$\Delta MHHI = \sum_j \sum_{k \neq j} \left(\frac{HHIAF_{jk}}{HHIWF_j} \right) s_k s_j$$

where $HHIAF_{jk} = \sum_i \gamma_{ij} \beta_{ik}$ measures the "across-firms" concentration arising from owners that have financial interests in firm-k and influence over the manager of firm-j, and $HHIWF_j = \sum_i \gamma_{ij} \beta_{ik}$ measures the "within-firm" concentration of the joint ownership and control of firm-k. Similarly, starting from a position of no cross-ownership, the PPI delta for firm-j can be written from (C5) as

$$\Delta PPI_j = \sum_{k \neq j} \left(\frac{HHIAF_{jk}}{HHIWF_j} \right) \frac{(P_k - C'_k)\delta_{kj}}{C'_j}$$

These expressions for the MHHI and PPI deltas depend in a similar way on the ratios of the within-firm and across-firms concentration of ownership and control. There are two main differences between the measures. First, the MHHI delta is based on shares, whereas the PPI delta depends on margins and diversion ratios. Second, the MHHI delta is measured across all firms in equilibrium, whereas a different PPI delta applies to each differentiated producer.

All else equal, the greater is the across-firms concentration from joint ownership of firm-k and control of firm-j, the greater is the weight placed on the cross-product of the shares of firms-j and k in the MHHI calculation and on the product of firm-k's margin and the diversion ratio from j to k in the PPI calculation. This makes intuitive sense; additional joint ownership and control, as measured by the across-firms $HHIAW_{ij}$ concentration measure, causes managers to internalize more of the adverse effects on cross-owned firms of an expansion in their output. On the other hand, the greater is the within-firm concentration of the ownership and control of firm-j, the smaller is the effect of an increase in concentration arising through the joint control of firm-j and ownership of firm-k. Intuitively, if the within-firm ownership and control of firm-j is already highly concentrated, then *additional* control exercised over firm-j by owners of firm-k has little *additional* influence over firm-j's management.

An example can clarify these intuitive arguments concerning the role of across-firms and within-firm concentration in determining the MHHI. Suppose that there are two firms, 1 and 2. Initially, firm-1 is wholly owned and controlled by owner-A, and firm-2 is wholly owned and controlled by owner-B. Suppose that owner-A buys an α share of firm-2. If the investment is a silent financial interest, the across-firms concentration factors are given by

$$HHIAF_{12} = \gamma_{A1}\beta_{A2} + \gamma_{B1}\beta_{B2} = (1)(\alpha) + (0)(1-\alpha) = \alpha,$$
$$HHIAF_{21} = \gamma_{A2}\beta_{A1} + \gamma_{B2}\beta_{B1} = (0)(1) + (1)(0) = 0,$$

and the within-firm concentration factors are

$$HHIWF_1 = \gamma_{A1}\beta_{A1} + \gamma_{B1}\beta_{B1} = (1)(1) + (0)(0) = 1,$$
$$HHIWF_2 = \gamma_{A2}\beta_{A2} + \gamma_{B2}\beta_{B2} = (0)(\alpha) + (1)(1-\alpha) = (1-\alpha).$$

The total weight applied to the cross-product s_1s_2 in the MHHI calculation is

$$\frac{HHIAF_{12}}{HHIWF_1} + \frac{HHIAF_{21}}{HHIWF_2} = \frac{\alpha}{1} + \frac{0}{1-\alpha} = \alpha.$$

Thus, the change in the MHHI when the owner of firm-1 (owner-*A*) takes a silent financial interest in firm-2 is $\alpha s_1 s_2$. This adjustment factor reflects the idea that, after the acquisition, the manager of firm-1 will take into account the effects of its output decision on the profits of firm-2 because the owner of firm-1 (owner-*A*) will have a partial interest in firm-2. This is the expression used to calculate incentive effects for a silent partial investment in the main body of the article.

Instead of a silent financial interest, suppose that owner-*A* exercises proportional control over the management of firm-2. In this case:

$$HHIAF_{12} = \gamma_{A1}\beta_{A2} + \gamma_{B1}\beta_{B2} = (1)(\alpha) + (0)(1-\alpha) = \alpha$$
$$HHIAF_{21} = \gamma_{A2}\beta_{A1} + \gamma_{B2}\beta_{B1} = (\alpha)(1) + (1)(0) = \alpha$$
$$HHIWF_1 = \gamma_{A1}\beta_{A1} + \gamma_{B1}\beta_{B1} = (1)(1) + (0)(0) = 1$$
$$HHIWF_2 = \gamma_{A2}\beta_{A2} + \gamma_{B2}\beta_{B2} = \alpha^2 + (1-\alpha)(1-\alpha),$$

and

$$\frac{HHIAF_{12}}{HHIWF_1} + \frac{HHIAF_{21}}{HHIWF_2} = \frac{\alpha}{1} + \frac{\alpha}{\alpha^2 + (1-\alpha)^2} = 2\alpha\left\{\frac{1-\alpha(1-\alpha)}{1-2\alpha(1-\alpha)}\right\}.$$

Thus, the increase in the MHHI from a partial investment α that confers proportional control is

$$\Delta MHHI = 2\alpha\,\frac{1-\alpha(1-\alpha)}{1-2\alpha(1-\alpha)}\,s_1s_2.$$

This is the expression used to calculate the incentive effects of proportional control.

The formulas for the other control scenarios discussed in the article for this example can be derived in an analogous way. The full merger case arises when $\beta_{A1} = \beta_{A2} = 1$ and $\gamma_{A1} = \gamma_{A2} = 1$. The total control case arises when $\beta_{A1} = 1$, $\beta_{A2} = \alpha$, and $\gamma_{A1} = \gamma_{A2} = 1$. One-way control, where

the acquiring firm influences the management of the acquired firm to maximize joint profits but acts independently with respect to its own pricing decision, occurs when $\beta_{A1} = 1$, $\beta_{A2} = \alpha$ and $\gamma_{A1} = 1$, $\gamma_{A2} = .5$. Coasian joint control is the same as a full merger. Proportional control occurs when $\beta_{A1} = \gamma_{A1} = 1$ and $\beta_{A2} = \gamma_{A2} = \alpha$.