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Overcoming Impediments to Information Sharing

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OVERCOMING IMPEDIMENTS TO INFORMATION SHARING±

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I. INTRODUCTION

The contemporary assessment of the competitive effects of information sharing among competitors is a showcase of the duality of public policy and antitrust law towards cooperation: Scholars recognize the potential anticompetitive effects of information sharing among competitors but at the same time acknowledge the social benefits derived from this business practice.[1] In particular, the literature emphasizes the social benefits of coordination in network industries.[2]

These are the positive and negative effects of information sharing on *social* welfare. But when deciding whether to share information, firms consider their *private* welfare. Discrepancies between social and private welfare may therefore lead firms to share information excessively to anticompetitive ends—in facilitating of cartels and other harmful horizontal practices.[3] Anti-

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1. *See, e.g.*, Dennis W. Carlton & J. Mark Klamer, *The Need for Coordination Among Firms, with Special Reference to Network Industries*, 50 U. CHI. L. REV. 446, 457 (1983) (pointing out the efficiency, and even necessity, of coordination among competitors in certain industries).

2. *Id.*; Douglas Lichtman, *Property Rights in Emerging Platform Technologies*, 29 J. LEGAL STUD. 615, 620-23 (2000) (discussing how, absent coordination between platform manufacturer and application manufacturer, positive externalities of each on the other result in excessive pricing or sub-optimal quality). This characteristic is common in critical infrastructures.

3. *See, e.g.*, Josh A. Goldfoot, *Antitrust Implications of Internet Administration*, 84 VA. L. REV. 909 (1998).

trust scholarship and case law have paid the latter problem much attention, and the analysis of anticompetitive coordination among competitors is quite sophisticated.[4]

Hitherto, however, legal analysts paid far less attention to another important type of discrepancy between the socially optimal and the likely private level of information sharing among competitors—that is, the problem of sub-optimal information sharing. Sub-optimal information sharing can generate significant social costs and is of special significance in network industries (including most critical infrastructures) because the maintenance of compatibility, which is key to producing positive network effects, typically requires information sharing.[5]

Understanding the neglected impact of sub-optimal information sharing is important for many areas of antitrust analysis, such as the evaluation of coordinated effects resulting from a merger;[6] the assessment of whether a joint venture is an illegal restraint of trade;[7] and the construction of condi-

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> The prohibition of horizontal restraints [such as information sharing and other cartel facilitating practices] attempts to police externalities by eliminating them, rather than by creating rights that third parties can agree to sell. Although horizontal restraints are profitable to their participants, they impose a cost on others by reducing the available number of contract choices. Normally, assigning the externality-affected party a property right it can sell or use to enjoin the externality-generating party maximizes efficiency. With horizontal restraints, however, it would be impractical to give third parties property rights in the market structure, allowing them to negotiate with the horizontal restraint participants, because horizontal restraints would affect so many market participants that the danger of holdouts would be high. Furthermore, economic theory would predict that such a transaction would never occur. Because the gains to cartel participants from setting prices are always less than the losses suffered by their customers, customers would require too high a price for their property right for the externality sale to be profitable to the cartel participants.
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> Antitrust regulations such as section 1 of the Sherman Act attempt to prevent such an extraction of rents completely by limiting parties' ability to cooperate.

Id. at 930-31 (footnotes omitted).

4. For a description of the contemporary analytic framework used by U.S. antitrust enforcement agencies to assess information exchange and other collaborations among competitors, see Fed. Trade Comm'n & U.S. Dep't of Justice, Antitrust Guidelines for Collaborations Among Competitors, 4 Trade Reg. Rep. (CCH) ¶ 13,161 (April 2000), *available at* http://www.ftc.gov/os/2000/04/ftcdojguidelines.pdf [hereinafter JV Guidelines].

5. *See, e.g.*, David J. Teece, *Information Sharing, Innovation and Antitrust*, 62 ANTITRUST L.J. 465 (1994).

> Compatibility standards are essential if products and their complements are to be used in a system. Computers need software, compact disc players need compact discs, televisions need programs, and bolts need nuts. Compatibility standards define the format for the interface between the core and complementary goods, so that, for example, compact disc players from any manufacturer may use compact discs from any music company.
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> . . . .
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> To establish common standards, meetings and exchanges of technical information are often necessary.

Id. at 473-74.

6. *See* 1992 Horizontal Merger Guidelines, 57 Fed. Reg. 41552 (Sept. 10, 1992), *available at* http://www.ftc.gov/bc/docs/horizmer.htm. Section 2.1 considers the likelihood that a firm would have access to certain information about competitors as a factor that increases the likelihood that the firm would agree with rivals on terms of a collusive agreement and would be able to detect and punish deviations from those terms. Thus, a higher likelihood that information on a rival would be acquired via information sharing increases the risk that a merger would be challenged as likely to cause harm to competition.

7. *See* JV Guidelines, *supra* note 4, at section 3.34(e) (considering likelihood of anticompetitive

tions in divestiture agreements pursuant to antitrust enforcement actions.[8] In all of these areas, an overstatement of the likelihood of information sharing among competitors can lead to an illegalization of, or the imposition of excessive restrictions on, some beneficial horizontal arrangements or transactions.

Moreover, the analysis of sub-optimal information sharing is also central to the formulation of public policy regarding network industries and critical infrastructures more generally.[9] For instance, the National Strategy for the Physical Protection of Critical Infrastructures and Key Assets, adopted in response to the attacks of September 11, 2001 and intended to map the future direction of national security policy, identified as a priority the achievement of a better understanding of impediments to security-related information sharing, to increase the security of privately owned or controlled critical infrastructures.[10]

Finally, a more accurate assessment of the likelihood of information sharing has implications not only for substantive law and public policy, but it also may advance the analysis of procedural rules. To wit, an important consideration in civil procedure, when shaping the rules of pre-litigation discovery proceedings (e.g., by deciding the scope of a privilege), is facilitating "free and open exchange of information during the presuit screening

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information sharing as a criterion in assessing the legality of a joint venture). *See also* United States v. Airline Tariff Publ'g Co., 1994-2 Trade Cas. (CCH) ¶ 70,687 (D.D.C. 1994) (competitive impact statement), *available at* http://www.usdoj.gov/atr/cases/f4700/4797.pdf (discussing antitrust charges brought by the Department of Justice alleging collusion between airlines facilitated by coded signals in information provided by the airlines to a computer reservation system).

8. *See, e.g.*, United States v. SBC Communications, Inc., 1999-2 Trade Cas. (CCH) ¶ 72,631 (D.D.C. 1999) (arguing that terms in a consent decree approving a merger subject to a divestiture, which prohibit the divesting company and the trustee responsible for the divestiture from exchanging non-public information, are "safeguards" that "protect against any competitive harm that could arise from coordinated behavior or information sharing between the two cellular systems after the merger, during the limited period while sale of the Cellular System Assets is not yet complete"); United States v. Sprint Corp., 1995 1996-1 Trade Cas. (CCH) ¶ 71,300 (D.D.C. 1995) (prohibiting parties to a consent decree from seeking non-public data about future prices or pricing plans of competitors, because "[r]isks of price collusion, tacit or explicit, are considerable in an industry with a small number of large providers offering similar types of services"). Inevitably, the conditions in both of the above consent decrees constrain some efficient transactions. Their justification, therefore, lies in their preventing anticompetitive information exchange that would otherwise take place.

9. An example of a network industry in which the scope of likely information sharing among rivals is directly regulated (and thus can be informed by this Article's analysis) is the natural gas industry, in which the Federal Energy Regulatory Commission regulates information sharing among pipelines and their affiliates. *See* FERC Order No. 497 (June 14, 1988). *See also* Tenneco Gas v. FERC, 969 F.2d 1187 (D.C. Cir. 1992) (discussing these orders).

10. The White House, *The National Strategy for the Physical Protection of Critical Infrastructures and Key Assets* (Feb. 2003), http://www.dhs.gov/interweb/assetlibrary/Physical_Strategy.pdf [hereinafter *The National Strategy*].

> Information sharing underpins any true partnership [between government and industry to protect critical infrastructures] and is necessary to mitigate the threat posed by a cunning, adaptive, and determined enemy. To formulate comprehensive security plans and make informed security investment and action decisions, individuals and institutions alike require timely, accurate, and relevant information. Accordingly, we must adopt measures to identify and evaluate potential impediments or disincentives to security-related information sharing and formulate appropriate measures to overcome these barriers.

Id. at 12-13.

process."[11] The less likely free exchange is to occur, however, the lower the expected benefit from promulgating discovery rules that are intended to enable such an exchange. Thus, insofar as the extant scholarship overstates the likelihood of information exchange among litigants, the impediments to information sharing examined in this Article may provide useful insights regarding the efficacy and proper scope of discovery and privilege.[12]

This Article advances the scholarly understanding of impediments[13] to information sharing in a number of significant ways. First, it shows that the strategic behavior of competitors may erect an economic barrier to information sharing that has not been previously addressed in the legal literature—the fear of degradation. Second, this Article reveals a hitherto unrecognized set of behavioral impediments to information sharing. Third, it integrates these economic and behavioral insights with the findings of the extant literature to create a new framework for predicting when private information sharing will be sub-optimal. Finally, this Article provides some tentative suggestions for aligning private information sharing with social optimality based on the framework developed here.

Structurally, Part II of the Article reviews the extant literature on information sharing focusing on the long-understood problem of free riding—that is, the ability of one actor freely (or more cheaply) to enjoy the benefits of the information its counterpart has produced at a cost. The risk of rivals' free riding reduces the incentive of each firm to collect and share information.[14]

Part III provides a novel discussion of the problem of degradation—namely, the private costs competitors must bear when sharing private information to their rivals' benefit.[15] This section challenges the common

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11. Cohen v. Dauphinee, 739 So. 2d 68, 72 (Fla. 1999) (discussing where a pre-suit affidavit that was required to initiate a medical malpractice action was protected from discovery and could not be admitted, because "free and open exchange of information will more likely occur if the parties are assured of the confidentiality of the information at trial"). On the application of the same goal to other privileges see, for example, GE Co. v. Sargent & Lundy, 916 F.2d 1119, 1129 (6th Cir. 1990) (stating that "[c]ommunications by parties and witnesses are protected to promote the development and free exchange of information and to foster judicial and extra-judicial resolution of disputes"); HPD Labs., Inc. v. Clorox Co., 202 F.R.D. 410, 414 (D.N.J. 2001) (noting, regarding the attorney-client privilege, that "[t]he law safeguards these communications to promote the full and free exchange of information and, in doing so, serves important public interests," yet recognizing the trade-off and stating that "because it restricts the availability of evidence, the privilege simultaneously obstructs the 'truth-finding process'"); EEOC v. Fina Oil & Chem. Co., 145 F.R.D. 74, 75 (E.D. Tex. 1992) (stating that the goal of government's deliberative process privilege is "to protect the full and free exchange of information in the agency").

12. Our analysis of information exchange among competitors is relevant for privileges and other discovery rules aimed at facilitating free exchange of information among current or prospective rival litigants. Rules facilitating information exchange among persons who are neither rivals nor potential rivals (e.g., most attorney-client and physician-patient privileges) are not directly affected by our analysis.

13. For the present purposes, we use the terms "impediments" and "barriers" interchangeably without making a distinction between them.

14. *See, e.g.*, Niva Elkin-Koren & Eli M. Salzberger, *Law and Economics in Cyberspace*, 19 INT'L REV. L. & ECON. 553, 559 (1999) ("[F]ree-riding reduces the incentives for investment in generating new information, and without government intervention information tends to be undersupplied.").

15. *See* Jacques Cremer et al., *Connectivity in the Commercial Internet*, 48 J. INDUS. ECON. 433

assumption that information is a non-rivalrous good, and thus points out that sharing information entails, besides the costs of collecting and disseminating information, the cost of losing a competitive edge over rivals that benefit from the information.

In Parts IV and V, the Article explores a number of robust behavioral phenomena[16] that impede rivals' ability to exploit circumstances where limited cooperation by way of information exchange becomes profitable.[17] Part IV focuses on the judgment stage—where market participants must determine the likely outcomes of the alternative courses of action available to them—showing how established rivalry norms[18] inhibit competitors' ability to identify profitable cooperation opportunities and how managers' risk attitudes[19] may lead them to underestimate the benefits of information sharing arrangements. Part V follows by exploring likely patterns of competitors' choices—revealing that their preference for maintaining the status quo[20] and aversion to comparative ambiguity[21] may lead competitors consciously to forego profitable, though risky, information sharing arrangements.

Finally, Parts VI and VII conclude the analysis, drawing together the economic and behavioral findings of this Article. Part VI identifies the circumstances where the various economic and behavioral impediments to socially beneficial information sharing are likely to exert their most significant effect, as well as the interaction between different impediments. Part VII concludes by considering those strategies and means, private and public, that may be effective in overcoming these impediments. In doing so, this Part lays a foundation for future research and effective legal policy in important areas of antitrust law, network industries, critical infrastructures, and procedural law.

(2000) (introducing the concept of degradation).

16. *See generally* Christine Jolls et al., *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471 (1998) (offering a broad vision of how law and economics could be improved by increasing its attention to insights about actual human behavior); Russell B. Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 CAL. L. REV. 1051 (2000) (examining the role of the rational actor in law and economics and discussing the implications of its replacement by a behaviorally informed actor).

17. For some recent applications of behavioral insights to the analysis of market behavior in antitrust law and economics, see Avishalom Tor, *The Fable of Entry: Bounded Rationality, Market Discipline, and Legal Policy*, 101 MICH. L. REV. 482 (2002) [hereinafter *The Fable of Entry*]; Avishalom Tor, Developing a Behavioral Approach to Antitrust Law and Economics: The Need, the Promise, and Some Limitations (May 2003) (unpublished manuscript, Harvard Law School, on file with author) [hereinafter Developing a Behavior Approach].

18. *See, e.g.*, Margaret M. Blair & Lynn A. Stout, *Trust, Trustworthiness, and the Behavioral Foundations of Corporate Law*, 149 U. PA. L. REV. 1735, 1773 (2001) (discussing the need to choose between norms of cooperation and competition).

19. *See, e.g.*, ZUR SHAPIRA, RISK TAKING: A MANAGERIAL PERSPECTIVE (1995) (providing a large-scale study of managerial risk attitudes and relating its findings to the broader behavioral literature).

20. *See, e.g.*, Daniel Kahneman et al., *The Endowment Effect, Loss Aversion, and the Status Quo Bias*, 5 J. ECON. PERSP. 193 (1991).

21. *See generally* Colin F. Camerer & Martin Weber, *Recent Developments in Modeling Preferences: Uncertainty and Ambiguity*, 5 J. RISK & UNCERTAINTY 325 (1992) (providing a comprehensive review of the literature).

II. THE ASSESSMENT OF INFORMATION SHARING IN THE EXTANT LITERATURE

Information sharing is among the most common forms of cooperation among firms. In some cases, it is a business necessity. For instance, where several trains use the same track, several power generators use the same electricity grid, or several firms utilize the same computer network, these firms cannot function without exchanging information about the use that one firm makes of the common facility or of the interfacing between the facility and another firm. In other cases, the exchange of information is a helpful, but not essential, means to economize the costs of producing mutually beneficial goods. To illustrate, firms may exchange information that is useful for business decisionmaking, so that each firm can specialize in acquiring the information that it is most efficient in discovering (e.g., information about the firm itself, information on a segment of the market in which other firms do not participate, etc.).

However, information exchange also has a dark side. Under certain market conditions, it can facilitate anti-competitive collusion or unilateral oligopolistic behavior. For example, airlines have allegedly used a common computer reservation system to signal to each other favorable terms for cartels, and to warn each other which prices were deemed by rivals as overly competitive.[22]

Due to the potential anti-competitive effect of information sharing, antitrust law frequently analyzes the likelihood that information sharing will facilitate collusion.[23] The economic framework underlying this analysis determines, for each form of information sharing considered, a firm's marginal private cost in participating in the information exchange[24] and the marginal private benefit derived from it.[25] Antitrust law expects a firm to participate in an information sharing plan where participation's marginal private benefit exceeds the marginal private cost.[26]

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22. *See* United States v. Airline Tariff Publ'g Co., 1994-2 Trade Cas. (CCH) ¶ 70,687 (D.D.C. 1994) (Competitive Impact Statement), *available at* http://www.usdoj.gov/atr/cases/f4700/4797.pdf (discussing antitrust charges brought by the Department of Justice alleging collusion between airlines facilitated by coded signals in information provided by the airlines to a computer reservation system).

23. *See* JV Guidelines, *supra* note 4. For a discussion of the types of information exchanges that may facilitate collusion, see HERBERT HOVENKAMP, FEDERAL ANTITRUST POLICY: THE LAW OF COMPETITION AND ITS PRACTICE 171-72 (1994).

24. This private cost includes, *inter alia*, the costs of conveying the information, of assessing received information in order to achieve the goal of the information sharing, and of maintaining a mechanism to ensure reciprocity of information exchange (if reciprocity is important to the given scheme).

25. "Private" costs and benefits differ from social costs and benefits in that they do not take into account externalities, whether positive or negative. For example, a cartel that raises prices and restricts output enhances the welfare of cartel members, but decreases the welfare of upstream and downstream firms. "Private" benefits to the cartel members from an information exchange that facilitates the cartel will not take into account the harm to other firms, but only the benefits to the cartel members. Thus, when deciding whether to share information, cartel members do not take into account the harm that this arrangement may cause suppliers and customers.

26. The assessment of both the costs and the benefits depends not only on the specific information sharing scheme that is assessed, but also on the environment (i.e., market conditions) in which it takes

The extant literature considers information a non-rivalrous good, the use of which by one party does not increase other parties' costs of using the same information.[27] This perceived quality suggests that information would be frequently shared, since in an environment in which information is competitively acquired,[28] the price that a producer of information would charge would not exceed much of the marginal cost of producing this information.[29] If information is non-rivalrous, copying information takes nothing away from the utility of the original information,[30] so the marginal cost is only the cost of disseminating the information to an additional "purchaser." Typically, this cost is not very high compared to the value of the information (and this cost seems to be declining with the development of new methods of information dissemination, such as the Internet).

As stated above, in assessing the likelihood of information sharing, antitrust law balances the costs of information sharing with its expected benefits.[31] The presumption of non-rivalrous consumption of information leads to assuming a low cost to information sharing, while on the private benefits side antitrust law distinguishes efficient (and hence competitive) from anticompetitive benefits.[32] Some scholars have argued that antitrust law is ex-

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place. *See, e.g.*, Andrew R. Dick, *When Are Cartels Stable Contracts?*, 39 J.L. & ECON. 241, 266 (1996) (examining the conditions conducive to or adverse to horizontal collusion (including information sharing)).

27. *See, e.g.*, Elkin-Koren & Salzberger, *supra* note 14; Mark A. Lemley, *Place and Cyberspace*, 91 CAL. L. REV. 521, 536 (2003) ("It is possible to imagine physical bandwidth or server capacity being overconsumed . . . . But it is not possible to imagine overconsumption of a nonrivalrous thing like data."); R. Polk Wagner, *Information Wants to Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 1001 (2003) ("In intellectual property, of course, we deal in intangible, nonrivalrous goods. . . . [M]ost [commentators] agree that information is inherently a public good, and thus some level of incentives (or other regulatory impetus) is required to ensure an adequate level of production." (footnotes omitted)); *id.* at 1001 n.20 (explaining that "[p]ublic goods are those where the cost of providing the good does not increase with consumption, and where it is generally infeasible to exclude others from consuming the good"). On non-rivalrousness and public goods generally, see Per-Olof Bjuggren & Henrik af Donner, *Ownership of a Cultural Landmark: The Case of Gotha Canal*, 21 INT'L REV. L. & ECON. 499, 504-05 (2002); Michael J. Trebilcock & Edward M. Iacobucci, *Privatization and Accountability*, 116 HARV. L. REV. 1422, 1433 (2003).

28. An environment in which information is competitively acquired is one in which an idea or its perfect substitute can be obtained from many different sources. This may happen, for example, when intellectual property rights do not exist or are not enforced to prevent persons possessing a copy of the information from making an additional copy and selling it to others, in competition with the original producer of the information. *Cf.* Lior Jacob Strahilevitz, *Charismatic Code, Social Norms, and the Emergence of Cooperation on the File-Swapping Networks*, 89 VA. L. REV. 505 (2003) (discussing a similar situation that occurs in some online file sharing networks, such as Napster or Gnutella, where the copying of music and video files on the Internet incurs a price very close to zero, so most often such files are not sold but provided freely).

29. *See, e.g.*, Malrite T.V. v. FCC, 652 F.2d 1140, 1151 n.16 (2d Cir.1981) ("In economic terms, price equals marginal cost in competitive equilibrium."), *referencing* W. NICHOLSON, MICROECONOMIC THEORY (2d ed. 1978).

30. And where there is a network effect to the information, for example, where popularity of the information enhances its value, distributing to others copies of the information would increase the utility from the original information. *See* Ariel Katz, *A Network Effects Perspective on Software Piracy*, U. Toronto L. & Econ. Research Paper No. 03-01, 2003, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id =386141.

31. *See supra* note 26.

32. *Cf.* JV Guidelines, *supra* note 4, at section 2.1 (discussing potential pro-competitive benefits of collaborations among competitors); *id.* at section 2.2 (discussing potential anti-competitive harms from

cessively suspicious of the motives behind firms' activities, too quick to find malevolent ends in what may be more plausibly perceived as an efficiency-enhancing collaboration.[33] But even if antitrust law does not exaggerate the anti-competitive benefit of information sharing, it would not require a significant benefit to exceed the typically low marginal cost of disseminating the information to an additional firm (assuming the consumption of information is non-rivalrous). Therefore, firms would be expected to share information quite frequently.

The literature does recognize an exception under which information will not be shared, despite the benefits from sharing exceeding the costs—the positive externality, or "free rider" problem.[34] The free rider problem and the solution anticipated in the literature stem from the characterization of information as non-exclusive but excludable.[35] This means that once information is produced or acquired, it may be shared and put to use by others at little additional cost, but it may also be hoarded and not shared.

The first trait—non-exclusivity—causes an externality in the production of information: information may potentially benefit many, but the benefits which the producer takes into account are only her own. Therefore, she would not likely put the same effort into producing information (and therefore less information will be produced) as she would have done if the benefit to all who could use the information were taken into account.[36] In an environment in which information is shared or competitively offered for sale, each person may shirk from uncovering new information, hoping that someone else will discover the information and then share it (allowing the shirker a "free ride").[37] Since everyone follows the same logic, some socially beneficial information sharing is lost.

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collaborations among competitors).

33. *See* Bryan Caplan & Edward Stringham, *Networks, Anarcho-Capitalism, and the Paradox of Cooperation*, REV. AUSTRIAN ECON. (forthcoming), *available at* http://www.gmu.edu/departments/economics/bcaplan/network2.doc (arguing that since cartel formation and maintenance are not self-enforcing while the provision of public goods may be—that is, if the benefits are internalized—one may believe that private firms can collaborate to provide public goods, yet be skeptical about the sustainability of collusion among them); Frank H. Easterbrook, *The Limits of Antitrust*, 63 TEX. L. REV. 1, 1-14 (1984) (criticizing antitrust law for excessively attributing anti-competitive goals to business behavior that could more plausibly be explained by a non-collusive justification).

34. *See, e.g.*, Elkin-Koren & Salzberger, *supra* note 14, at 559. *But see* Yochai Benkler, *Coase's Penguin, or, Linux and the Nature of the Firm*, 112 YALE L.J. 369, 438-39 (2002) (arguing that free riding may not thwart production of a public good in a commons environment, if the free riders merely shirk and do not harm production, the benefit from the public good to the non-shirkers is sufficiently high and they believe there is a sufficient number of non-shirkers to produce the public good).

35. *See, e.g.*, Elkin-Koren & Salzberger, *supra* note 14, at 559.

36. *See* Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960) (introducing the concept of externalities).

37. Even where information is not provided for free, it is often cheaper to pay the competitive market price (i.e., marginal cost) rather than rediscover the information. This is due to the fact that producing information tends to incur high fixed costs, which are associated with discovering the information, while the marginal cost (which, assuming a non-rivalrous use of the information consists primarily of the cost of disseminating the information to the marginal party) tends to be much smaller.

In the second trait—excludability—lies a solution to the problem created by the first. Since information can be excludable (e.g., the producer of information can withhold it from others or assert intellectual property rights),[38] she may be able to transact with other producers and receive compensation from them that would make it worthwhile for her to produce more information (but only as much as is warranted by the compensation she can bargain from the other users). This mechanism is imperfect, because there are transaction costs both to maintaining excludability (e.g., costs of keeping the information secret or releasing it selectively), and to negotiating a deal to share the information (e.g., the more potential users of the information, the more deals need to be struck to internalize all the externalities; the combined cost of many deals may be significant).

The imperfection in the ability to internalize externalities involved in producing and distributing information (and other non-exclusive goods) has resulted in a wide array of institutions that aim to improve internalization, including the firm,[39] vertical integration,[40] and private legal systems.[41] Such institutions internalize the externality typically by monitoring and enforcing investment in collecting and disclosing information or by allowing selective disclosure of information only to those who share in the costs of producing the information.

Above we described in a nutshell the framework used by antitrust law and other scholarship on the economics of cooperation. We believe this framework ignores some issues and as a result, the framework's predictions of the likelihood of exchanging information are often overstated.[42] In the following Parts we examine these issues, some of which involve dynamic effects of the information exchange that a rational firm would take into account, while others involve commonplace deviations from strictly rational behavior.

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38. *Cf.* Elkin-Koren & Salzberger, *supra* note 14, at 559 ("[T]he use of information cannot be efficiently excluded. This is because information has no physical boundaries, and its duplication and distribution involve relatively low costs. The marginal costs of exclusion are often greater than the marginal costs of provision, so it is inefficient to spend resources to exclude nonpayers." (footnote omitted)). But conceding that through intellectual property entitlements, exclusion becomes economically feasible.

39. *See* Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937) (explaining that business is conducted in firms when operations within a firm incur fewer transaction costs than incurred by similar operations through market transactions).

40. *See* Benjamin R. Klein et al., *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297 (1978).

41. *See, e.g.*, Lisa Bernstein, *Opting Out of the Legal System: Extralegal Contractual Relations in the Diamond Industry*, 21 J. LEGAL STUD. 115 (1992) (discussing the production and dissemination among diamond traders of information as to traders' honesty and trustworthiness); Avner Greif, *Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition*, 83 AM. ECON. REV. 525 (1993) (discussing the production and dissemination of information on the honesty of merchants' agents).

42. The same issues may, in some circumstances, cause the framework to understate the likelihood of exchanging information.

III. THE PROBLEM OF DEGRADATION

A. The Rivalrous Characteristic of Information

The axiom that sharing information among competitors (or, for that matter, other forms of cooperation among competitors) is non-rivalrous is a gross oversimplification. An analytical framework that fails to take into account the private cost to a firm of allowing its competitor to benefit from an information exchange, as does the prevalent framework, will overestimate the likelihood of information sharing.

Intuitively, yet contrary to the assumption commonly made in the literature,[43] the "consumption" of information by competing firms often has significant rivalrous characteristics. Exclusive possession of useful information provides a firm with a competitive advantage[44] over its rivals (or reduces rivals' competitive advantage against the firm).[45] Seen in reverse, sharing such information with rivals enhances their competitive position vis-à-vis the firm possessing the information. This is a cost that is considered by the firm in deciding whether to share information with rivals and reduces the firm's private incentives to engage in information sharing.[46]

For example, Acme Corporation ("Acme") is contemplating sharing information on cost saving techniques employed in the production process of widgets with its rival, Adversary Incorporated ("Adversary"). Acme realizes that by reducing its production costs, Adversary would be able to offer widgets at prices more competitive with Acme's, thereby causing Acme to lose revenue, either by being forced to reduce the prices of its widgets or by losing some of its sales to Adversary. This does not mean that Adversary cannot offer Acme a price that would compensate it for the lost revenue. But the fact that sharing information with Adversary would result in lost revenue to Acme will increase the price Acme would demand for sharing the information above that which Acme would have demanded if the use of information were non-rivalrous (i.e., if sharing the information with Adversary would not reduce Acme's profits).[47] Therefore, the increased price de-

43. *See, e.g.*, Elkin-Koren & Salzberger, *supra* note 14, at 559.

44. "Competitive advantage" means that the firm's goods or services are less costly to produce or more valuable to customers than those of rivals lacking this information.

45. An exception to this rule exists in those cases where the information is only useful to facilitate collusion. In such cases, the firm benefits from sharing information with others.

46. Society's welfare is not necessarily enhanced by the private benefit a firm achieves from gaining a competitive advantage over a rival. One firm's gain is another firm's loss. Nonetheless, society's welfare may be affected by the efficiencies that bring about the competitive advantage, or by the effect of the competitive advantage on competition. The individual firm, however, considers its private costs and benefits, and therefore will treat the loss of competitive advantage due to information sharing as a cost, regardless of the effect (or lack thereof) on society's welfare.

47. The price Adversary would be willing to offer Acme for the information would depend, among other things, on who else would receive the information. The fewer people who know of the cost-cutting technique, the more significant the benefit to the few that do know of it. Thus, Adversary may offer a certain price conditioned on Acme not selling others the same information. Exclusivity might not be Acme's best bet, though. The more firms use the cost-saving technique, the more pressure mounts on the remaining firms to also acquire that knowledge; firms without the cost-saving knowledge would lose

manded for the information most likely results in fewer information exchanges. Thus, a model ignoring the rivalrous quality of information may overstate the likelihood of information sharing.

However, if a transfer of information is reciprocal, firms would seem to have the correct incentive to share information, even if the consumption of information is rivalrous. If sharing information with a rival yields a net social benefit (that is, the use of the information by the rival results in some benefit other than or in addition to an improved competitive position vis-à-vis the informant), then the firms' reciprocal commitment to share information with each other would allow each of them to realize the efficiencies of using this shared information while the competitive advantage from this information, gained by each firm against its rival, would be offset by a similar gain by the rival.

Modifying the example above, suppose that both Acme and Adversary have knowledge of (different and cumulative) improvements to the widget production process and they agree to exchange information. Assuming both improvements provide similar competitive advantages, an exchange would result in both companies increasing their competitive advantage over other firms yet remaining in the same competitive position with respect to each other (since receiving the other firm's cost-cutting secret offsets the loss of the advantage provided by divulging their own cost-cutting secret). Thus, only the costs of conveying the information would be compared to the benefits of the information exchange (the enhanced advantage over third party rivals), as the extant literature commonly assumes.[48]

Nevertheless, situations such as the one previously described—where the exchange of information occurs as soon as the benefits of the exchange exceed its costs—are most likely uncommon because they require the fulfillment of two underlying conditions. First, there must be a mechanism to ensure that both parties comply with the agreement to exchange information. Second, all parties to the information exchange have information that is of approximately similar utility and that each party's information will provide similar competitive advantages (so that none of the partners to the information exchange gains a net competitive advantage over other partners as a result of the exchange).

Under the first condition, there must be a mechanism to ensure that both parties comply with the agreement to exchange information. If the information exchange is a simultaneous, one-time event, then compliance may not be difficult. But useful commercial information can rarely be exchanged so

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revenue to rivals with lower production costs. Conveying the information to one firm, therefore, results in a negative externality to all other firms, and this negative externality induces firms to race to acquire the information lest they be disadvantaged in comparison to the rest of the market. *Cf.* Oriana Bandiera, *Land Reform, the Market for Protection, and the Origins of the Sicilian Mafia: Theory and Evidence*, 19 J.L. ECON. & ORG. 218, 219 (2003) (making a similar argument regarding the purchase of "protection" from the Sicilian Mafia, where the negative externality is the diversion of crime from protected properties to those not protected by the Mafia).

48. *See, e.g.*, Elkin-Koren & Salzberger, *supra* note 14.

simply. The exchange often necessitates extensive training and, in other instances, the timetables for transferring different types of information do not overlap so the exchange would not be simultaneous. In other instances, the nature of the information exchange requires not a singular event but a continuous relationship that leaves either party vulnerable to the other party's opportunistic breach of the agreement. When the exchange cannot occur simultaneously, some institution, whether public (like the judicial system) or private (reputation bonds, collateral, etc.), must police the exchange. Such institutions are often in place and typically mitigate the free riding problem. However, sometimes the institutions are unavailable or limited in their effectiveness.[49]

The second condition for the exchange of information, the requirement that all parties to the information exchange have information that is of approximately similar utility and will provide similar competitive advantages, is even less frequently fulfilled than the first. In most cases, firms differ in the value that they derive from certain information. Using our earlier example, assume that Acme and Adversary have equal costs initially but that Acme's innovation reduced the cost of producing a widget by 10%, while Adversary's innovation (which is different and cumulative) will reduce costs by 7%. Through the information exchange, Acme will be able to reduce its widget production costs by an additional 7%, but Adversary will be able to reduce its production costs by an additional 10%. As a result, Adversary would be able to gain a competitive advantage over Acme (perhaps reducing its prices by 10% and forcing Acme to either do the same and cut 3% off its gross margin, or risk losing sales to Adversary). Acme still reaps a 7% cost reduction, which can make it more competitive against all rivals but Adversary. But if the revenue increase due to those benefits is smaller than the revenue loss to Adversary (plus the costs of exchanging the information and policing the exchange agreement), Acme will decline to exchange information.

This form of strategic behavior—taking actions that inflict a greater harm on one's rivals than inflicted on oneself, and thus seizing competitive advantages over the rival—is known in the antitrust literature as "raising rivals' costs."[50] When this action takes the form of refusing cooperation or compatibility (in our case, declining to share information), we call it "degradation."[51] In the rest of this section, we will discuss the strategy behind

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49. *See* Amitai Aviram, *Regulation by Networks*, BYU L. REV. (forthcoming 2003) (manuscript at 14-15, on file with author). Given the complexity of some information exchanges and the informational advantage of the transferor over the transferee and third parties, an outside institution may have difficulty detecting more subtle violations of an information exchange agreement. Thus, even when an institution exists to enforce reciprocal information exchanges, the effectiveness of that institution might be limited.

50. *See* Steven C. Salop & David T. Scheffman, *Raising Rivals' Costs*, 73 AM. ECON. REV. No. 2, at 267, 267 (1983).

51. In network environments, where the term first formed, degradation is a predatory act that weakens the network, harming smaller firms more than larger ones, and therefore giving the larger firms an advantage over smaller competitors. *See* Aviram, *supra* note 49 (manuscript at 25).

information exchange and related analytical literature. Degradation is particularly significant in network environments, where cooperation and compatibility are essential to realizing network benefits. Therefore, we will emphasize the particular manifestations of degradation in network environments.

B. Degradation (With an Emphasis on Network Environments)

The notion that a competitive advantage can be attained not only through a "positive" effort of improving one's goods or services but also through a "negative" effort of harming the goods or services of one's rivals (through increasing cost or reducing quality),[52] is quite intuitive. Such casual relationships are found not only in the realm of inter-firm commercial competition, but also in interpersonal relationships and intra-firm competition—such as that between employees over promotions and status within the workplace.[53] Only very recently, however, was a model of competition among employees known as a "promotion tournament" modified to take into account employees' negative efforts (e.g., sabotage) against their co-workers.[54]

Negative efforts have been recognized in the antitrust scholarship, where they are called predatory practices.[55] Predation has long been a matter of concern for antitrust law.[56] Historically, many firms attempted to gain a competitive advantage or eliminate competition altogether through industrial espionage, bribery, extortion, and outright harm to their rivals.[57] In the congressional debates over the Federal Trade Commission Act, for instance, Senator Newlands stated that the National Cash Register Company in fact "had men in the employ of their rivals, that they had every form of espionage and detection, and that they even resorted to bribery of the employees of the rival concerns."[58]

Outside of these extreme (and generally rare) forms of predation, however, the anti-competitive motive is more difficult to ascertain and the behavior becomes easier to disguise.[59] Antitrust did not develop a theory of

52. *See* ROBERT H. BORK, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF 134 (Free Press 1993) (1978).

53. For an example of concerns regarding intra-firm competition among employees resulting in some employees harming their colleagues to advance themselves, see Amy Joyce, *Your Colleagues or Competitors?*, WASH. POST, June 8, 2003, at F6.

54. Kong-Pin Chen, *Sabotage in Promotion Tournaments*, 19 J.L. ECON. & ORG. 119 (2003).

55. BORK, *supra* note 52, at 144.

56. *See id.* at 144-48.

57. *See, e.g.*, Steven L. Salop & Lawrence J. White, *Economic Analysis of Private Antitrust Litigation*, 74 GEO. L.J. 1001 (1986).

58. 51 CONG. REC. 11,108 (daily ed. June 25, 1914). For one account of the legislative history of the FTC Act, see Robert H. Lande, *Wealth Transfers as the Original and Primary Concern of Antitrust: The Efficiency Interpretation Challenged*, 50 HASTINGS L.J. 871 (1999).

59. *See* BORK, *supra* note 52, at 160. Ascertaining the motives behind firms' strategies is challenging not only when these acts are predatory, but also when they are collusive. For example, parallel behavior of competitors (e.g., similar pricing) is often expected to be the result of collusion. Yet in some cases, such behavior may be the result of intense competition that drives all firms' prices down to their

non-price predation until Salop and Scheffman's paper,[60] which shed light on the concept of negative effort by introducing the strategy of "raising rivals' costs."[61] While this concept has been advanced in later scholarship and adopted by the enforcement agencies,[62] its importance grew dramatically with the emergence to prominence of network industries.

Network environments are business sectors in which network effects significantly impact business dynamics.[63] Network effects occur where the value of consuming a good increases the more others consume that good.[64] Internet marketplaces exemplify this behavior (e.g., eBay).[65] If we want to sell an item, the probability that we will find a potential buyer increases as more people use the same Internet marketplace.[66] And as buyers, the probability that we find a person wishing to sell the very item we seek increases as more people use the marketplace.[67] One can think of network effects as the inverse of congestion—in a congested highway, my utility from the highway declines with each additional car using the same highway. To some extent, this may be true for Internet marketplaces as well—possibly, a high volume of usage slows down the operation of the marketplace. Yet the network effect is the more dominant of these two effects, at least up to a certain level of usage. Marketplaces offering a large number of participants are usually seen as superior to their smaller counterparts, even if they are a little slower than the latter.

Since network effects are a function of the joint usage of a network,[68] maintaining compatibility between network members is crucial for the realization of network effects. The harm from thwarting the network is not evenly distributed, however: the larger the individual firm, the lower the relative benefit gained from becoming part of a larger network. For exam-

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(similar) marginal costs. Furthermore, a frictionless cartel would result in less parallel behavior than that of either firms in perfect competition or firms in a non-collusive oligopoly. *See, e.g.*, James L. Smith, *Distinguishable Patterns of Competition, Collusion and Parallel Action*, MIT Center for Energy and Environmental Policy Research, Working Paper No. 2003-006, May 16 2003, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=410321.

60. Salop & Scheffman, *supra* note 50.

61. *Id.*

62. *See, e.g.*, Terry Calvani, *Non-Price Predation: A New Antitrust Horizon*, 54 ANTITRUST L.J. 409 (1985).

63. *See* David S. Evans & Richard Schmalensee, *A Guide to the Antitrust Economics of Networks*, ANTITRUST, Spring 1996, at 36 ("[A] defining characteristic of network industries, in the sense we are using the term here, is that increasing returns [in consumption—i.e., network effects] are important enough to be a fundamental determinant of industry structure and market behavior.").

64. *See* Aviram, *supra* note 49 (manuscript at 10-11); Michael L. Katz & Carl Shapiro, *Network Externalities, Competition and Compatibility*, 75 AM. ECON. REV. No. 3, at 424, 424 (1985) (describing the network effects phenomenon as one in which "the utility that a user derives from consumption of the good increases with the number of other agents consuming the good").

65. *See* Cremer et al., *supra* note 15.

66. *See* Katz & Shapiro, *supra* note 64.

67. *See id.*

68. Networks are institutions that facilitate interconnection between users of a good or service exhibiting network effects, and thus enable the realization of network effects. *See* Amitai Aviram, *The Paradox of Spontaneous Formation of Private Legal Systems*, 22 YALE L. & POL'Y REV. (forthcoming 2004) (manuscript at 5, on file with author).

ple, suppose two telephone companies compete in a market. Firm A has 10,000 subscribers, while Firm B has only 10. If both firms make their systems compatible and interconnect them, Firm A will be able to offer its subscribers 10 more people to call (an increase of 0.1%), while Firm B will be able to offer its subscribers 10,000 more people to call (an increase of 100,000%). Naturally, Firm B is likely to be much more eager to interconnect. Firm A, on the other hand, may find that interconnection would place Firm B on equal footing to it in competing for customers, harming the interests of Firm A far beyond the benefit to be gained from a 0.1% expansion of the network.

Thus, firms may have incentives to refuse to become compatible—or, if already compatible, to refuse to interact, such as to exchange information—even when compatibility (or information exchange) would increase social welfare. This phenomena was noted some time ago by scholars in the field of industrial organization.[69] Farell and Saloner observed that in deciding whether to make two technologies compatible when one technology is supplied by a single firm, that firm may have an incentive to make conversion costly.[70] Cremer, Rey, and Tirole expanded on this insight, terming this increase in the cost of compatibility (or a reduction in its quality) "degradation."[71] Degradation has been observed (or at least alleged), *inter alia*, in the credit card industry,[72] the Internet backbone industry,[73] and the telephone industry.[74]

As the phone companies example above made clear, in networks containing both larger and smaller firms, the larger firms may gain from weakening the network and competing with the smaller members in conditions closer to those that would exist in the absence of a network.[75] These larger

69. *See, e.g.*, Joseph Farrell & Garth Saloner, *Converters, Compatibility, and the Control of Interfaces*, 40 J. INDUS. ECON. 9, 26-28 (1992).

70. *Id.*

71. Cremer et al., *supra* note 15.

72. *See* Amitai Aviram, Accommodating a New Tenant in the House of Cards: Introducing Competition into a Network Industry (June 2003) (unpublished manuscript at 30-31, on file with author).

73. Cremer et al., *supra* note 15.

74. *See, e.g.*, Goldwasser v. Ameritech Corp., 222 F.3d 390, 395 (7th Cir. 2000) (noting that customers of the incumbent telephone company ("incumbent") allege, among other things, that incumbent "has failed to provide interconnection between its network and those of competitors that is equal to the interconnections it gives itself," that incumbent's competitors "have experienced undue delays (presumably caused by [incumbent]) in acquiring unbundled elements, and those delays have precluded them from offering services as attractive as [incumbent's]," and that incumbent "has continued to bill customers of competitors who have converted from –[incumbent's] services, and hence some customers are being double-billed, thereby harming the competitors' good will"); Cavalier Tel., LLC v. Verizon Va., Inc., 208 F. Supp. 2d 608, 612-16 (E.D. Va. 2002) (discussing that an entrant phone company alleging, *inter alia*, that incumbent mis-routed its calls, provided inferior databases and web-based interfaces for ordering loops or last-mile facilities, made the process of ordering last-mile facilities (which it controlled) "lengthy, complex, and expensive," and intentionally made the billing process for loops costly for its competitors).

75. In most cases, the degrading firm is limited to depriving the other network members of the marginal network benefits attributable to the transactions contributed by the degrading firm. Only in rare cases could a degrading firm deprive other network members from network effects they confer on each other. In all other cases, victims of degradation still benefit from network effects created collectively by them. Therefore, unless the degrading firm is the only significant participant in the network, degradation

firms can do so by excluding others from their network (e.g., refusing to exchange information with rivals) or by reducing connectivity with other members of the network (such as by exchanging less information with the smaller rivals).[76]

Degradation does not necessarily amount to complete disconnection from a network.[77] But degradation through lower interconnection quality (or through existing but imperfect compatibility) is much harder to detect and much more prevalent.[78] The following hypothetical illustrates such a strategy:[79] Goliath Corporation ("Goliath") is a telephone company with a 70% market share. Goliath makes modifications to the facilities connecting it with other telephone companies, so that any call between a customer of Goliath and a customer of a competing company suffers from static noise. Calls in which both parties are Goliath customers, and calls not involving Goliath customers, are not impacted. Betty is a customer of David Incorporated ("David"), a small competitor of Goliath. Approximately 70% of the people she calls are Goliath customers (correlating with Goliath's market share). This means that if she remains a customer of David, 70% of her calls will suffer from static noise. If she switches from David to Goliath, static noise will impact only 30% of her calls (those to non-Goliath customers). Therefore, all else being equal, Betty is likely to switch to Goliath. This is precisely the reason Goliath adopted a strategy of degradation, though the quality of its service suffers from the degradation (as 30% of the calls are of lower quality than before), it hurts the quality of the competitors' services much more (70% of their calls are affected, in our example). The migration of customers to the larger network more than compensates the larger company for the loss resulting from the reduced quality of its own degraded service.

In the case of the telephone signals' interconnection, degradation appears as a reduction in the quality signal (i.e., static noise). Similarly, when the interconnection between companies takes the form of information exchanges (e.g., interconnection between credit card companies, which consists of information on transactions between a cardholder of one company and a merchant working with the other company), degradation appears as a refusal to exchange information, a slower exchange of information, or the commission of errors in the information that is exchanged.

Degradation makes strategic use of reduction in cooperation or compatibility. While this strategy is typically useful for large firms against smaller rivals, it can also be employed based on other vulnerabilities of rival firms. For example, Bank A and Bank B are contemplating connecting their

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usually will not cause market conditions to be as if there was no network at all.

76. *See* A. Douglas Melamed, *Network Industries and Antitrust*, 23 HARV. J.L. & PUB. POL'Y 147, 152-56 (1999).

77. *See* Aviram, *supra* note 49, at 41.

78. *See id.* at 43 (stating that "the 'correct' degree of connectivity is very difficult to determine").

79. This example is taken from Aviram, *supra* note 49, at 39-40.

online banking networks. If they connect, they will offer their clients a wider array of options, and they will save some costs in maintaining the network (as compared to maintaining two separate networks); however, once the networks are connected, breaching one bank's security system would enable access to the other bank's system as well. The banks' customers differ in their preferences regarding online banking: Bank A's customers primarily receive the bank's services online, while Bank B's customers mostly rely on the bank's "bricks and mortar" branches and do very little of their business online.

Consequently, Bank A is more vulnerable to hackers. Bank B would not be willing to invest as much as Bank A in securing the network, since it would not be harmed as much by a breach in computer security. Furthermore, if the banks are each other's main competitor, Bank B may gain customers from Bank A if the online system is breached. Therefore, Bank B would underinvest in computer security (a form of degradation), and it may refuse to exchange information and coordinate with Bank A, if the information exchange enhances the security of the network. Anticipating Bank B's behavior, Bank A is less likely to share information (or otherwise cooperate) with Bank B.

We have discussed in this Part some important, yet neglected, aspects of the cost-benefit analysis that rational firms would undertake when deciding whether to share information. In reality, however, as the empirical literature on judgment and choice clearly shows, business decisionmaking does not strictly follow rational action precepts.[80] Instead, market actors exhibit systematic deviations from rational actor models, such as those underlying the extant scholarship on information sharing.[81]

IV. DETERMINING THE PROSPECTS OF INFORMATION SHARING: JUDGMENT UNDER UNCERTAINTY

Unlike the purely economic impediments to information sharing—those that appear when market participants act in a way that is privately optimal for them but socially sub-optimal—behavioral impediments can lead real-world, boundedly rational[82] decisionmakers to exhibit levels of information

80. *See, e.g.*, *The Fable of Entry*, *supra* note 17, at 503.

81. For a discussion of the applicability of such deviations in market settings and their legal significance, see *The Fable of Entry*, *supra* note 17, at 560-67.

82. The term "bounded rationality" designates human decision behavior that, while showing systematic and predictable patterns, does not conform to the normative requirements of strictly rational decisionmaking. This idea was originally developed by Herbert A. Simon. Herbert A. Simon, *A Behavioral Model of Rational Choice*, 69 Q.J. ECON. 99 (1955), *available at* http://www.jstor.org/view/00335533/di951739/95p0100q/0; Herbert A. Simon, *Rational Choice and the Structure of the Environment*, 63 PSYCHOL. REV. 129 (1956) (discussing the concept of bounded rationality to denote the effects of the limitations of human cognition on decisionmaking). For a discussion of the term "bounded rationality" and further references, see *The Fable of Entry*, *supra* note 17, at 484 n.2. *See also* J. Bendor, *Bounded Rationality*, *in* INTERNATIONAL ENCYCLOPEDIA OF THE SOCIAL AND BEHAVIORAL SCIENCES 1303, 1303-04 (Neil J. Smelser & Paul B. Baltes eds., 2001); R. Radner, *Bounded and Costly Rationality*, *in* INTERNATIONAL ENCYCLOPEDIA OF THE SOCIAL AND BEHAVIORAL

sharing that are even privately sub-optimal. This section therefore explores those behavioral impediments that, at times, impact competitors' judgments of the attractiveness of information sharing.

A. Uncertainty and the Attractiveness of Information Sharing

Before determining whether to engage in information sharing, market participants need to assess the risks, costs, and benefits of such an arrangement. If, and only if, the assessment reveals the arrangement to have a positive net present value ("NPV"), rational managers would embark upon it.[83] When considering information sharing, however, competitor managers inevitably make their judgments under uncertainty. They can try to assess the magnitude of the potential benefits to their businesses from information sharing and the likelihood that such benefits will occur; they can also try to judge the magnitude and probability of occurrence of those risks and costs involved in a given information sharing arrangement—such as those resulting from free riding or degradation. Nonetheless, these managers' predictions will be uncertain and probabilistic, since they obviously cannot know the future of the prospective arrangement with certainty.

For perfectly rational, value-maximizing decisionmakers, the uncertainty of the prospects of information sharing would not necessarily be of concern. After all, while the benefits of information sharing are bound to be uncertain, so are the costs and risks of this arrangement.[84] If estimated benefits of information sharing must be adjusted downwards—taking into account the possibility that they will not materialize—so will also be the case with the costs and risks of the arrangement.[85] On balance, therefore, in the absence of a clear, asymmetrical impact of uncertainty on the two sides of scale, the diminished expected value of the one side is compensated for by a comparable effect on the other side.[86]

To give a simple illustration, assume that Bank A is considering sharing information with Bank B. After researching the prospects of this arrangement, Bank A's managers estimate the potential benefit to be $1,000,000 and the potential costs to be $600,000. If all these sums were certain, the value of the arrangement would be $400,000—an exceptionally profitable proposition. If, on the other hand, both the benefit and the downside risk of the arrangement (but not the direct costs, for simplicity's sake) were equally

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SCIENCES, *supra*, 1298, 1298-99 (both defining bounded rationality more broadly than Simon's original formulation).

83. *See, e.g.*, RICHARD A. BREALEY & STEWART C. MYERS, PRINCIPLES OF CORPORATE FINANCE 15-34 (6th ed. 2000).

84. *See, e.g., id.* at 221-23.

85. *See, e.g., id.*

86. A full NPV analysis would also adjust the present value downwards further, taking into account the risk involved in the prospective arrangement. *See, e.g., id.* at 15-24, 221-23, 246-75. Consequently, this risk would reduce the present value of the arrangement beyond the proportionate reduction on both the benefits and costs sides. A simplified analysis that disregards these further adjustments does not change the basic findings and will therefore suffice for the present purpose.

uncertain, say with an 80% probability of occurrence, the expected value obviously would be lower. Now the expected benefit would amount to $800,000 (80% * $1,000,000) and the expected costs to $480,000 (80% * $600,000), with the expected value of the arrangement now being $320,000.[87]

This example also highlights a number of important points about determining value under uncertainty. First, when the benefits and costs of a financial proposition are equally uncertain, the financial proposition's expected value diminishes proportionally. In these circumstances, a proposition bearing a positive value under certainty will still have a positive, albeit smaller, expected value under uncertainty.

Second, when the benefits and costs—as will commonly be the case—are not equally likely, the attractiveness of information sharing under uncertainty will not only differ from that under certainty but may also bear an opposite sign, such that a seemingly attractive, positive value arrangement will be unattractive or vice versa. For instance, if, in the example above, the potential benefit had been only a 50% chance of materializing, while the potential downside were very likely, with a 90% probability, the originally profitable arrangement would now be unprofitable—generating an expected loss of $40,000.[88]

Third, the frequently asymmetric impact of uncertainty on the future benefits and costs of information sharing becomes even more significant in those common cases where the arrangement bears virtually certain, upfront, direct costs. Such costs, even when seemingly small compared to the ultimate benefits and costs of information sharing, can sometimes transform an attractive proposition into a financially untenable one. Assume, for instance, that the arrangement in our original example[89] requires an upfront investment of $150,000, which is virtually certain. Now, information sharing would still be profitable under certainty, with a value of $250,000. However, even with an equal degree of uncertainty as to the ultimate benefits and costs of the arrangement, the outcome is less clear cut. If the probability of these benefits and costs were as high as 80%, information sharing would still be beneficial, with an expected value of $170,000.[90] If, on the other hand, the probability of the ultimate benefits and costs were only 35%, the arrangement would already be unprofitable, producing an expected loss of $10,000.[91]

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87. A full NPV analysis would also discount future benefits and costs, taking into account the time value of money. *See, e.g., id.* at 40-45. For simplicity, however, the examples here will treat NPV as expected value ("EV") unless otherwise noted.

88. Since 50% * $1,000,000 – 90% * $600,000 = -$40,000.

89. Assume that Bank A is considering sharing information with Bank B. After researching the prospects of this arrangement, Bank A's managers estimate the potential benefit to be $1,000,000 and the potential costs to be $600,000. If all of these sums were certain, the value of the arrangement would be $400,000.

90. Since 80% * ($1,000,000 - $600,000) - $150,000 = $170,000.

91. Since 35% * ($1,000,000 - $600,000) - $150,000 = -$10,000. Note the effect of up front costs that are not discounted will be even greater than suggested by the example, since the future benefits and

Hence, the attractiveness of any given information sharing arrangement for a profit-maximizing decisionmaker will depend on the balance of benefits and costs under uncertainty. Where, as may often be the case, the benefits of information sharing are more tangible and probable than the costs resulting from free riding and degradation, a profitable arrangement is more likely. Where the opposite holds, on the other hand, and the costs of information sharing are expected to occur with high probability, such an arrangement in less likely profitable. Moreover, the common need for a virtually certain, upfront investment of resources in the arrangement further diminishes the profitability of information sharing, with the impact of this factor increasing, as the need for an upfront investment increases and the probability of the ultimate outcomes decreases.

Nevertheless, there will be many occasions on which a traditional economic analysis of information sharing will still conclude that profit-maximizing market participants will embark on an information sharing exchange, even taking into account the effects of uncertainty when examining the impact of free riding and degradation. In the remainder of this Article we will show, however, that a number of behavioral factors combine further to impede information sharing among competitors. Based on the analysis of these factors, we predict that competitors will often exhibit sub-optimal levels of information sharing, below those anticipated by models assuming perfectly rational profit maximization. In other words, our analysis will show that a greater proportion of benefits to costs often will be required for information sharing among competitors to occur.[92]

B. Norms of Rivalry: Recognizing the Value of Limited Cooperation

Social norms[93] often impact judgments under uncertainty.[94] Norms help decisionmakers interpret their social environment, giving meaning to am-

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costs will be discounted.

92. Other ways to overcome impediments to information sharing are discussed in detail *infra*.

93. Different definitions of the term "social norms" abound in legal scholarship. *E.g.*, Robert D. Cooter, *Decentralized Law for a Complex Economy: The Structural Approach to Adjudicating the New Law Merchant*, 144 U. PA. L. REV. 1643, 1656-57 (1996) (defining norms as obligations); Melvin A. Eisenberg, *Corporate Law and Social Norms*, 99 COLUM. L. REV. 1253, 1255 (1999) (defining norms as "all rules and regularities concerning human conduct, other than legal rules and organizational rules"); Richard H. McAdams, *The Origin, Development, and Regulation of Norms*, 96 MICH. L. REV. 338, 340 (1997) (defining norms as "informal social regularities that individuals feel obligated to follow because of an internalized sense of duty, because of a fear of external non-legal sanctions, or both"); Eric A. Posner, *Law, Economics, and Inefficient Norms*, 144 U. PA. L. REV. 1697, 1699-1701 (1996) (defining norms as rules distinguishing desirable and undesirable behaviors while giving a third party the authority to punish those engaging in behaviors that are undesirable); Lior Jacob Strahilevitz, *Social Norms from Close-Knit Groups to Loose-Knit Groups*, 70 U. CHI. L. REV. 359, 364 n.24 (2003) (defining norms as "behavioral regularities that arise when humans are interacting with each other"); Cass R. Sunstein, *Social Norms and Social Roles*, 96 COLUM. L. REV. 903, 914 (1996) (using a rough definition of norms as "social attitudes of approval and disapproval, specifying what ought to be done and what ought not to be done").

94. Scholars often observe that norms constrain choices by defining appropriate and inappropriate behaviors in different circumstances. However, while norms can merely constrain choices without exerting any deeper impact on preferences or judgments, they may also more fundamentally construct those

biguous behaviors of others and suggesting appropriate reactions to these behaviors.[95] In fact, by defining accepted modes of conduct and interaction in different circumstances, social norms can also alert human actors to the need for a change in behavior. [96] When decisionmakers recognize a sufficient change in circumstances such that an extant norm no longer applies, they either apply a different norm or make an ad hoc judgment of the situation at hand.[97]

For example, when the behavior of others seems to conform to relevant norms, the actor's own behavior can follow habitual routines without requiring any special attention or thought.[98] An apparent violation of accepted norms on the part of others, on the other hand, is alarming. A violation of accepted norms signals to the actor a need to reassess the situation and examine whether behaviors different from those suggested by the current norm may be more appropriate, whether others have violated a common norm, or whether a change in the situation merits a change in one's behavior.

In this way, norms help facilitate and stabilize social interaction. They frequently absolve individuals in society of the need continually to make judgments of appropriate behaviors, and allow us to direct our limited mental resources to those problems and situations that merit greater attention by virtue of their being unique, unusual, or simply different. Sometimes, therefore, social norms can play an efficiency-promoting role, although they are unlikely to be efficient per se.[99]

At other times, however, even those generally beneficial social norms will have an efficiency-decreasing effect. This will be the case, for instance,

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preferences and impact those judgments that underlie choices. *E.g.*, Sunstein, *supra* note 93, at 913 ("[W]e might say that preferences are constructed . . . by social situations, in the sense that they are very much a function of the setting and the prevailing norms." (emphasis omitted) (footnote omitted)).

95. For one quite rare analysis that relates the function of social norms to their underlying psychological mechanisms and anchors the discussion in the empirical evidence accumulated by social psychologists, see Jeffrey J. Rachlinski, *The Limits of Social Norms*, 74 CHI.-KENT L. REV. 1537 (2000). Rachlinski also notes the impact of norms on judgment under uncertainty. *Id.* at 1547 ("Group norms can also affect people's perceptions and beliefs."); *id.* at 1564 ("[P]eople actively interpret the social circumstances in which they find themselves, making subjective reality as important a determinant of behavior as objective reality.").

96. Although this shorthand description captures the nature of the problem discussed here, in reality, of course, multiple norms apply in any given situation, and a change in behavior results from a shift in the balance of different norms or in a change in the dominating norm. *E.g.*, *id.* ("[I]n most circumstances, multiple social forces push social behavior in opposite directions.").

97. *See, e.g.*, Rachlinski, *supra* note 95.

98. *See, e.g.*, *id.*

99. Legal scholars debate whether norms tend to be efficient. *E.g.*, Jody S. Kraus, *Legal Design and the Evolution of Commercial Norms*, 26 J. LEGAL STUD. 377 (1997) (arguing that commercial norms will be more efficient than rules based on individual analysis and experimentation, but are still unlikely to be optimal); Posner, *supra* note 93 (arguing that norms are unlikely to be efficient); Mark J. Roe, *Chaos and Evolution in Law and Economics*, 109 HARV. L. REV. 641 (1996) (arguing against the efficiency of commercial norms). *But see* Lisa Bernstein, *Merchant Law in a Merchant Court: Rethinking the Code's Search for Immanent Business Norms*, 144 U. PA. L. REV. 1765 (1996) (arguing the legalization of otherwise efficient business norms may undermine that efficiency); Cooter, *supra* note 93 (arguing that a free business community will have efficient norms in the absence of nonconvexities or spillovers to other communities).

when decisionmakers continue to conform to an obsolete norm even when the situation will have changed in a way that merits the application of an altogether different norm (or at least a change in the extant norm). Such an outcome will be especially likely when the situation has changed in subtle or ambiguous ways.[100]

But when others continue to conform to a norm that has become inappropriate due to changed circumstances, the actor is also less likely to detect the relevant change. In these settings, therefore, the generally useful stabilizing function of social norms becomes a burden, impeding the adaptation of people's behavior to changed circumstances. Moreover, even when one actor determines that a change of norm is due, it is still difficult effectively to create such a change. One can send a signal by violating the extant norm, but such a move will often lead to a negative reaction and possibly a social sanction from others. More likely, the circumstances will have to change in a sufficiently unambiguous manner so that other actors will also identify the possible need for a change.

Norms of rivalry among competitors may therefore erect one significant behavioral barrier to information sharing.[101] Market participants constantly compete with their rivals for profitability, market share, and market power.[102] Often, the success of one participant comes at the expense of its rivals. Moreover, competitors must be on guard from strategic behavior on the part of their rivals.[103]

Society, of course, encourages intense competition in the market as the foundation of a healthy, prosperous economy.[104] The competitive model, in fact, is deeply embedded in our culture,[105] and is directly promoted in the training of business decisionmakers.[106] The law, especially antitrust law,

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100. *E.g.*, Rachlinski, *supra* note 95, at 1551 (discussing psychological studies showing, *inter alia*, that the effect of norms on judgment tends to linger); *id.* at 1565 (repeating the same conclusion but also noting that decisionmakers' continuous interpretation of their social environment undermines this effect); *cf.* Dan M. Kahan, *Gentle Nudges vs. Hard Shoves: Solving the Sticky Norms Problem*, 67 U. CHI. L. REV. 607 (2000) (characterizing internalized norms that are slow to change in the face of contradictory criminal laws as "sticky").

101. *E.g.*, Blair & Stout, *supra* note 18, at 1773 ("Yet a third possibility is that players look to others' behavior as a signal in a novel and otherwise ambiguous social situation of what the appropriate norm of conduct is, and whether the context calls for primarily cooperative or competitive behavior.").

102. *See, e.g.*, MICHAEL E. PORTER, COMPETITIVE STRATEGY, at xiii-xx (1980).

103. *E.g.*, Salop & Scheffman, *supra* note 50.

104. *See, e.g.*, FREDERIC M. SCHERER & DAVID ROSS, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 18 (3d ed. 1990) (asking "[w]hy is a competitive market system held in such high esteem" and "[w]hy is competition the ideal in a market economy").

105. For one lucid description, see Richard Hofstadter, *What Happened to the Antitrust Movement?*, *in* THE PARANOID STYLE IN AMERICAN POLITICS AND OTHER ESSAYS 188, 193-98 (1965).

106. Competitive strategy is central to current business school education. Harvard Business School, which is typical in this respect, includes a required course on the topic in the first year M.B.A. curriculum. *See* Harvard Business School Curriculum, http://www.hbs.edu/mba/experience/learn/curriculum/requiredcurriculum/term2.html. Additionally, Harvard Business School offers a whole unit of elective courses on competition and strategy. *See* Harvard Business School Curriculum, http://www.hbs.edu/mba/admin/acs/index.html. For more information on this subject, see Albert A. Foer, *The Third Leg of the Antitrust Stool: What the Business Schools Have to Offer to Antitrust*, 47 N.Y.L. SCH. L. REV. 21 (2003).

sends a clear message to market participants regarding the importance of free and vigorous competition,[107] emphasizing the illegality and anti-competitiveness of cartels and many other horizontal restraints of trade.[108]

However, while norms of intense rivalry are crucially important to the economy, they can also, like other efficiency-promoting norms, bring about inefficient outcomes. This will be the case, for instance, where highly competitive market participants will seek to compete using unfair or illegal means, sometimes to the detriment of consumers and competition at large.[109]

> Our working hypothesis implicitly consisted of the following elements: (1) antitrust is largely about how business firms behave in their rivalrous inter-relations; (2) firms behave on the basis of decisions made by individual managers and directors; (3) business schools teach future managers and directors about the nature and norms of competition; (4) what is thought and what is taught in the business schools are likely to affect how firms actually compete; and (5) this information may confirm, supplement, or contradict the ways in which antitrust analysis is currently handled.

Id. at 21 (introducing a conference titled *"What Do Business Schools Teach About Antitrust?"*); Norman W. Hawker, *Antitrust Insights from Strategic Management*, 47 N.Y.L. SCH. L. REV. 67 (2003) (reviewing the main characteristics of current business school education on competitive strategy).

107. Thus, the Sherman Act has been titled "[a]n act to protect trade and commerce against unlawful restraints and monopolies." The Sherman Act, ch. 647, 26 Stat. 209 (1890) (codified as amended at 15 U.S.C. §§ 1-2 (2000)). The Supreme Court has pronounced and reiterated this value on numerous occasions. *See, e.g.*, N. Pac. Ry. v. United States, 356 U.S. 1 (1958).

> The Sherman Act was designed to be a comprehensive charter of economic liberty aimed at preserving free and unfettered competition as the rule of trade. It rests on the premise that the unrestrained interaction of competitive forces will yield the best allocation of our economic resources, the lowest prices, the highest quality and the greatest material progress, while at the same time providing an environment conducive to the preservation of our democratic political and social institutions. But even were that premise open to question, the policy unequivocally laid down by the Act is competition.

Id. at 4.

108. Thus, while the modern view of antitrust is more nuanced, recognizing that some horizontal restraints are pro-competitive and some vertical ones are anti-competitive, the common understanding that the former types of restraints tend to be more problematic underlies much of the traditional distinction between per se illegality and the rule of reason. *See, e.g.*, Oreck Corp. v. Whirlpool Corp., 579 F.2d 126 (2d Cir. 1978) (en banc), *cert. denied*, 439 U.S. 946 (1978).

> It is important to distinguish between "horizontal" restraints, *i.e.* agreements between competitors at the same level of market structure, and "vertical" restraints, *i.e.* combinations of persons at different levels of the market structure, such as manufacturers and distributors. *Horizontal restraints alone have been characterized as "naked restraints of trade with no purpose except stifling competition," and, therefore, per se violations of the Sherman Act.* On the other hand, while vertical restrictions may reduce intrabrand competition by limiting the number of sellers of a particular product, competing for a given group of buyers, they also promote interbrand competition by allowing a manufacturer to achieve certain efficiencies in the distribution of its products. They are, therefore, to be examined under the rule of reason standard.

Id. at 131 (emphasis added) (citations omitted). *See also* Polygram Holding, Inc., 5 Trade Reg. Rep. (CCH) ¶ 15,453 at 22,453-22,458 (FTC 2003), *available at* http://www.ftc.gov/os/2003/07/polygramopinion.pdf, slip op. at 13-29 (providing a recent detailed synthesis of the law of horizontal restraints).

109. Aggressively competitive behavior that harms only competitors does not violate the antitrust laws. For a recent discussion of different definitions of harm to competition and their implications, see Eleanor M. Fox, *What is Harm to Competition? Exclusionary Practices and Anticompetitive Effect*, 70 ANTITRUST L.J. 371 (2002). *See also* BORK, *supra* note 52, at ix-xiv (summing up the early Chicago School argument regarding the need to rationalize this concept).

Importantly, however, rivalry norms can also lead to inefficient outcomes by inhibiting market participants' abilities to recognize limited opportunities for efficient cooperation and impeding the establishment of such cooperative arrangements. Rivals, who regularly engage in intense competition, will have difficulty ascertaining under uncertainty when precisely limited cooperation—such as information sharing—becomes privately beneficial despite their general rivalry.

Consequently, a potentially beneficial cooperative arrangement will have to promise far greater advantages than the merely positive NPV required for its establishment according to models of rational profit maximization.[110] Competitors will also find it difficult, moreover, to convey the mutual desirability of partial cooperation to their counterparts, especially where the objective economic impediments of free riding and degradation are present and where some forms of cooperation among competitors are illegal.[111] In this way, the "stickiness" of norms can erect a behavioral barrier to information sharing.

C. Managerial Risk Perceptions and the Illusion of Control

When rivals do consider the possibility that they might benefit from information sharing, they must judge the prospects of such an arrangement. However, managerial risk perceptions and the illusion of control combine to make information sharing appear less attractive than an objective, rational actor based analysis would suggest.

Decisionmakers often deem themselves able to control chance occurrences and risky eventualities, especially when final outcomes depend on a mixture of skill and chance, exhibiting the illusion of control.[112] Managers, furthermore, appear especially prone to overestimate their ability to control certain chance events. They do not consider themselves risk takers but rather "risk controllers," sophisticated actors who only take calculated, controlled risks. Managers believe that "managerial risk taking is an endeavor where a manager can use his *judgment*, exert *control*, and utilize *skills*."[113]

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110. *See supra* note 83.

111. One psychological phenomenon that may well contribute to this difficulty is "reactive devaluation," whereby adversaries tend to devalue proposals solely because they have been offered by their counterparts. *See* Lee Ross & Constance Stillinger, *Barriers to Conflict Resolution*, 7 NEGOTIATION J. 389, 392 (1991); Russell Korobkin & Chris Guthrie, *Psychological Barriers to Litigation Settlement: An Experimental Approach*, 93 MICH. L. REV. 107, 150-60 (1994) (providing a detailed discussion of the limited evidence on this phenomenon).

112. *See* Ellen J. Langer, *The Illusion of Control*, 32 J. PERSONALITY & SOC. PSYCHOL. 311 (1975) (also citing earlier studies); *see also* David V. Budescu & Meira Bruderman, *The Relationship Between the Illusion of Control and the Desirability Bias*, 8 J. BEHAV. DECISION MAKING 109, 110 (1995) (citing additional studies). This illusion stems from people's inability to distinguish between "skill" and "chance" situations and their more general desire to believe they can control the world around them. It leads to inflated expectations of personal success in tasks whose outcomes depend, in part or in whole, upon chance factors. *Id.* at 109-10; Langer, *supra*, at 313.

113. *See, e.g.*, SHAPIRA, *supra* note 19, at 46-49 (1995) (reporting managers' emphasis on control and skills). Reporting the findings of this in-depth study of managerial perspectives on risk using a sample of over 700 managers, Shapira notes:

When they find a potential venture too risky or when they think that they cannot manage the risks associated with the venture effectively, they are likely to refrain from embarking on it.[114]

This tendency makes competitor managers less inclined to expose themselves to "uncontrolled" risks, such as ceding control of important information regarding their operations to their rivals. This is especially true when that information could be used strategically to their disadvantage.[115] Information sharing will thus appear less attractive, all else being equal, than maintaining a purely competitive relationship without ceding any control. Hence, although they usually only have a limited degree of control with respect to the risks they face in the daily operation of their businesses, managers' belief in their control of these risks, on the one hand, and their aversion to facing seemingly uncontrolled risks, on the other hand, join to diminish the attractiveness of partial cooperation with rivals.

The illusion of control has also been shown to diminish managers' sensitivity to probability estimates, leading them to give more weight to the anticipated value of the "downside" risk of a venture than to the probability that this risk would materialize.[116] Therefore, competitor managers may be less inclined to share information in the face of a low probability but potentially harmful downside risk, for example, from the strategic use of degradation by their rivals.

Insofar as market participants find information sharing "risky" due to the apparent loss of control involved in information sharing, they are also likely to underestimate the benefits of such an arrangement and its likelihood of success. Additionally, they are likely to overestimate the costs involved in this sharing. Exhibiting an affect heuristic, that leads to the alignment of benefits and costs estimates with risk perceptions regarding various activities.[117]

When judging an activity they consider risky, decisionmakers tend to believe it is also not beneficial.[118] This belief is nevertheless bound to be wrong on most occasions since, in reality, risks and benefits are more often

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> [The managers] believed that risk was manageable. Seventy-three percent of the respondents saw risk as controllable. As a result, they made a sharp distinction between gambling (where the odds are exogenously determined and uncontrollable) and risk taking (where skill or information can reduce the uncertainty). The situations they faced seemed to them to involve risk taking but not gambling.

Id. at 73 (citing earlier studies reporting managers' perceptions of their ability to control risks in addition to the above quote).

114. *Cf. id.* at 74-78.

115. *See supra* Part III.B.

116. SHAPIRA, *supra* note 19, at 43-53; *see also* James G. March & Zur Shapira, *Managerial Perspectives on Risk and Risk Taking*, 33 MGMT. SCI. 1404, 1411-12 (1987) (describing and discussing reasons for managerial insensitivity to probability in risk estimates).

117. *See* Paul Slovic et al., *The Affect Heuristic, in* HEURISTICS AND BIASES: THE PSYCHOLOGY OF INTUITIVE JUDGMENT 397, 410-13 (Thomas Gilovich et al. eds., 2002) (reviewing the relevant evidence).

118. *See, e.g.*, Melissa L. Finucane et al., *The Affect Heuristic in Judgments of Risks and Benefits*, 13 J. BEHAV. DECISION MAKING 1 (2000).

positively than negatively correlated with one another.[119] After all, activities bearing a high risk but a low benefit are unlikely ever to take place, while highly beneficial activities may be embarked upon, despite the risks involved.[120] This is especially true in the financial domain, where the relationship between risk and return is fundamental to the economic theory of investment decisionmaking. Nevertheless, there is evidence that even professional analysts base their risk and return judgments on a global affective attitude, judging unfamiliar stocks as bearing both low return *and* high risk if those stocks were perceived as "bad" and vice versa if they were perceived as "good."[121]

In fact, recent studies show that, because of the affect heuristic, people's judgments of the benefits of different activities tend to change when they learn new information about the risks involved in these activities.[122] For instance, when learning that a certain source of energy is riskier than they previously thought it to be, decisionmakers' estimates of the benefits from using that source diminish, despite being provided with no evidence to that effect.[123]

Finally, the evidence on the illusion of control reveals that some variables—typically the same factors that people associate with success in skill-dependent tasks—determine the strength of the illusion.[124] A number of these variables, however, are likely to lead rival managers to disfavor partial cooperation by information sharing, as compared to maintaining strictly competitive relationships. Studies show, for instance, that decisionmakers think their odds of winning a pure chance gamble are greater when they are more familiar or skilled with either the stimulus (e.g., the particular lottery ticket) or the necessary response; when they are actively (versus passively) involved in the task; and importantly, when competition is present.[125]

These variables—namely, familiarity, a more active role, and the presence of competition—operate more strongly in pure competition among rivals than in partial cooperation. Rivals are less familiar with the new prospects of information sharing; they are unlikely to be as dominant and active in the joint cooperative arrangement as they are in their own businesses; and, most obviously, cooperative information sharing inevitably diminishes the degree of competition among rivals.

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119. *See id.* at 3.

120. *See id.* at 3-4 (reviewing studies showing this effect and discussing the objective relationship between risk and benefit).

121. *See* Yoav Ganzach, *Judging Risk and Return of Financial Assets*, 83 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 353 (2000).

122. *See* Finucane et al., *supra* note 118, at 9.

123. *Id.* at 13.

124. *See generally* Langer, *supra* note 112.

125. *E.g.*, *id.* at 315 (Experiment 1, competition), 318 (Experiment 3, stimulus familiarity), 319-20 (Experiment 4, response familiarity), and 320-22 (Experiments 5-6, type of involvement). As Langer herself notes, moreover, the phenomena revealed by experimental findings using pure chance devices such as lottery tickets and gambles should operate even more powerfully in real-world settings, where it is truly difficult to distinguish skill and luck effects. *See id.* at 324.

Managers' perceptions of risk, in light of their illusion of control and related phenomena, may therefore erect an additional impediment to information sharing. Thus, even those competitors who overcome the inhibiting effect of rivalry norms and attempt to judge the prospects of information sharing are likely to find information sharing less attractive than objectively warranted. Managers' tendencies to overestimate the prospects of pure competition over novel partial cooperation therefore make it likely they will recognize as profitable only those arrangements that bear a significantly positive—as opposed to marginally profitable NPV.

V. THE DIFFICULTY OF EMBARKING ON AN INFORMATION SHARING ARRANGEMENT: BOUNDEDLY RATIONAL DECISIONMAKING

Competitors are likely to be slower in recognizing the possibility of profitable information sharing than traditional economic theories allow because of the persistence of rivalry norms. They also tend to underestimate the attractiveness of such partial cooperation compared to remaining in a purely competitive setting, that seems better controlled. The development of cooperative information sharing is further likely to be impeded, moreover, by market participants' preference for maintaining the status quo and avoiding comparatively ambiguous alternatives, unless they recognize a far superior alternative. Consequently, market participants' mere identification of a profit-maximizing information sharing arrangement typically will not make the arrangement a sufficiently attractive opportunity.

A. The Biasing Power of the Status Quo: Loss Aversion and Omission Bias

Loss aversion and the status quo bias are fundamental characteristics of human decisionmaking.[126] The standard economic assumption in financial decisionmaking is that preferences do not depend on current assets but, instead, on the decisionmaker's overall asset position.[127] In other words, when choosing among different options, it should not matter to rational actors, for instance, how these options relate to the current state of affairs, but how these options compare in terms of their NPV.[128]

A substantial amount of psychological evidence shows, however, that reference points play a large role in determining preferences among options. Specifically, numerous studies show that decisionmakers commonly evaluate their options as gains and losses relative to the status quo.[129] They also find potential losses far more painful than they find comparable potential

126. *See, e.g.*, Kahneman et al., *supra* note 20, at 194.

127. *See, e.g.*, Amos Tversky & Daniel Kahneman, *Loss Aversion in Riskless Choice: A Reference-Dependent Model*, 106 Q.J. ECON. 1039, 1039 (1991).

128. *See, e.g.*, BREALEY & MYERS, *supra* note 83, at 93-113.

129. Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 ECONOMETRICA 263 (1979).

gains beneficial, and show a diminishing sensitivity to both losses and gains, such that the marginal value of both diminishes with their size.[130]

To illustrate, when faced with a hypothetical choice, between *A*—after having been given $1000, the participant has a 50% chance of getting another $1000 or otherwise nothing—and *B*—after having been given $1000, the participant can get another $500 for sure—a dramatic majority of participants choose the latter option.[131] This choice reflects risk aversion. At the same time, other participants were told that they have been given $2000 and then had to choose between *C*—a 50% chance of losing $1000 or otherwise nothing—and *D*—losing $500 for sure. The latter participants showed a clear preference for the former, risk-seeking option.[132] Analytically, however, the option pairs *A* and *C*, and *B* and *D*, are identical in terms of total asset position! Thus, if choices were made based on absolute outcomes rather than reference points, participants should not have exhibited opposite preferences across the two conditions.[133]

One important implication of loss aversion is that market participants have a strong tendency to remain in the status quo, because the disadvantages of leaving the status quo loom larger than the advantages of doing so.[134] Decisionmakers have been shown to exhibit a status quo bias in many domains including hypothetical choices about jobs, financial investments, and policy issues.[135] In one real life case, for instance, Harvard employees exhibited a status quo bias in choosing their medical plans and the allocation of pension reserves.[136] Reviewing this evidence, the researchers who originally introduced the term loss aversion noted that models ignoring the status quo bias "will present excessively radical conclusions, exaggerating individuals' responses to changing economic variables and predicting greater instability than is observed in the world."[137]

Thus, rivals exhibiting loss aversion will find the prospect of information sharing as compared to a status quo of non-cooperation less attractive than information sharing is objectively. They will tend to exhibit privately sub-optimal levels of information sharing, failing to share until the perceived benefits of such a practice appear dramatically greater than the costs. While loss aversion is pervasive in decisionmaking, moreover, other psychological and economic variables reinforce the status quo bias.

Specifically, some scholars have argued this bias can be explained on purely rational economic grounds, without reference to psychological evi-

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130. *See, e.g., id.* at 265-67 (introducing a range of findings on risky decisionmaking in violation of expected utility theory and offering what has become a leading alternative descriptive model).

131. *E.g., id.* at 273 (Problem 11).

132. *E.g., id.* (Problem 12).

133. *See, e.g., id.* (Problems 11-12).

134. *See, e.g.,* Kahneman et al., *supra* note 20, at 194; William Samuelson & Richard Zeckhauser, *Status Quo Bias in Decision Making*, 1 J. RISK & UNCERTAINTY 7 (1988) (introducing the term and providing a range of findings to support it).

135. *Id.*

136. *E.g., id.*

137. *Id.* at 47.

dence.[138] Some of these economic variables have limited relevance in the case of information sharing, applying only in those circumstances where the costs of analyzing the potential arrangement or the transaction costs involved in consummating information sharing are large when compared with the anticipated benefits.[139] In these cases, strictly rational and fully informed decisionmakers will hold to the purely competitive status quo instead of moving to a more profitable information sharing arrangement, because the costs associated with the move outweigh the benefits to them.

Another economic factor, however, which may apply to decisionmaking in somewhat broader circumstances, is asymmetric information.[140] In such a model, the party that is uninformed takes into account the possibility that the other party has private information about the true value of the options.[141] Hence, insofar as the value of information sharing to the informed party is a function, in part, of the costs to the uninformed party—such as when the risk of degradation is present—the uninformed party will rationally incorporate this possibility by making a downward adjustment in its estimates of the present value of the arrangement. This phenomenon may also be the case when both parties know their counterparts possess relevant private information.[142]

In addition to loss aversion, omission bias—that is, decisionmakers' tendency to react more strongly to actions as compared to inactions that lead to similar outcomes—may be partly responsible for the status quo bias.[143] After all, under most circumstances, moving away from the status quo also involves action, while maintaining the status quo does not. Like loss aversion, this variable also operates in circumstances where rational actor models, including those accounting for the effects of transaction costs and asymmetric information, would expect information sharing to take place. Omission bias also resembles loss aversion in being reference dependent.[144]

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138. *See* Tversky & Kahneman, *supra* note 127.

139. Samuelson & Zeckhauser, *supra* note 134.

140. For one recent attempt to account for some of the phenomena typically associated with loss aversion on asymmetric information grounds, see Dominique Y. Dupont & Gabriel S. Lee, *The Endowment Effect, Status Quo Bias and Loss Aversion: Rational Alternative Explanation*, 25 J. RISK & UNCERTAINTY 87 (2002).

141. *Id.* at 88.

142. Note, however, that it is doubtful whether real parties are likely properly to take into account asymmetric information. *See, e.g.*, Avishalom Tor & Max H. Bazerman, *Focusing Failures in Competitive Environments: Explaining Decision Errors in the Monty Hall Game, the Acquiring a Company Problem, and Multi-Party Ultimatums*, 16 J. BEHAV. DECISION MAKING 353 (2003) (showing that decisionmakers make systematic errors in competitive games because they fail to take into account the impact of information held only by other parties on the decisions likely to be made by these other parties in light of the rules of the game).

143. *See* Ilana Ritov & Jonathan Baron, *Reference Points and Omission Bias*, 59 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 475, 495 (1994) [hereinafter *Reference Points*]; Ilana Ritov & Jonathan Baron, *Status Quo and Omission Biases*, 5 J. RISK & UNCERTAINTY 49 (1992) [hereinafter *Status Quo*].

144. Meaning the impact of omission bias occurs because market participants make their choices by comparing options to a baseline, commonly the status quo, instead of examining these options' outcomes in terms of overall asset position. *See supra* note 130 and accompanying text.

A number of studies suggest that people prefer risky omissions to comparable risky commissions.[145] For instance, in one study, many participants preferred not to vaccinate a child when the risk of death was twice as great from disease (10 in 10,000) as from vaccination (5 in 10,000).[146] Omission biases have also been shown to occur in hypothetical financial decisions, where participants find a negative outcome of financial loss worse when it was the result of an action (e.g., switching stock holdings from one company to another) than inaction (e.g., not switching the holdings).[147]

The stronger affective reaction to the negative outcomes of commissions, as compared to omissions, frequently contributes to the status quo bias. After all, in most situations—as well as in the case of rivals considering engaging in information sharing—an omission implies holding to the status quo. A commission, on the other hand, typically involves moving away from the status quo to another alternative. On these occasions, decisionmakers will tend to exhibit a status quo bias, because the potentially negative outcomes of such a move are perceived as more painful than those of inaction.

B. Aversion to Comparative Ambiguity

Even when competitors determine that a potential information sharing arrangement bears a positive NPV, they may still further discount its value in their choices due to comparative ambiguity aversion.[148] Ambiguity aversion—namely, decisionmakers' preference for options with more certain outcome probabilities over options with less certain outcome probabilities but equal expected values—"is one of the most robust phenomena documented in the decision making literature."[149] Competitors who are averse to ambiguity, however, will sacrifice value willingly to avoid the less familiar,

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145. *E.g.*, Ilana Ritov & Jonathan Baron, *Reluctance to Vaccinate: Commission Bias and Ambiguity*, 3 J. BEHAV. DECISION MAKING 263 (1990); Mark Spranca et al., *Omission and Commission in Judgment and Choice*, 27 J. EXPERIMENTAL PSYCHOL. 76 (1991).

146. Ritov & Baron, *supra* note 145. There is also real-world evidence for omission bias in gambling, where inaction is preferred to action in the face of high-probability losses, although the expected value of the latter is greater than that of the former. Willem A. Wagenaar & Gideon B. Keren, *Calibration of Probability Assessments by Professional Blackjack Dealers, Statistical Experts, and Lay People*, 36 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 406 (1985); *see also* Daniel Kahneman & Dale T. Miller, *Norm Theory: Comparing Reality to Its Alternatives*, 93 PSYCHOL. REV. 136 (1986) (discussing these findings and relating them to the emotional asymmetry between action and inaction).

147. Daniel Kahneman & Amos Tversky, *The Psychology of Preferences*, 246 SCI. AM. 160 (1982); *Status Quo*, *supra* note 143.

148. *See* Hillel J. Einhorn & Robin M. Hogarth, *Decision Making Under Ambiguity*, *in* RATIONAL CHOICE: THE CONTRAST BETWEEN ECONOMICS AND PSYCHOLOGY 41, 44-46 (Robin M. Hogarth & Melvin W. Reder eds., 1987). For an instructive summary of the findings on ambiguity aversion, see Colin Camerer, *Individual Decision Making*, *in* 1 THE HANDBOOK OF EXPERIMENTAL ECONOMICS 587 (John H. Kagel & Alvin E. Roth eds., 1995). *See generally* Camerer & Weber, *supra* note 21 (providing a comprehensive review of the literature).

149. Gideon Keren & Leonie E. M. Gerritsen, *On the Robustness and Possible Accounts of Ambiguity Aversion*, 103 ACTA PSYCHOLOGICA 149, 149 (1999).

more ambiguous option of information sharing as compared to maintaining their current, purely competitive practices.[150]

Beginning in the early 1960s, experimental evidence of ambiguity aversion started to amass.[151] Experimental tests consistently have shown that participants prefer unambiguous gambles—such as betting on drawing a red ball from a one hundred-ball urn with fifty red and fifty black balls—over ambiguous ones (e.g., where the distribution of red and black balls in the urn was either unknown or within a range of, say, fifteen to eighty-five red balls).[152] In many other studies, subjects have been found to forego substantial amounts—around ten percent to twenty percent of the expected value of the bets—to avoid the ambiguous option.[153] And while there is some limited evidence of ambiguity preference, these findings are limited to betting on gains with ambiguous low probabilities, or losses with ambiguous high probabilities.[154]

Ambiguity aversion has also been shown to impact decisionmaking in experimental auction markets.[155] In these experiments, ambiguous and unambiguous lotteries were auctioned using a number of different auction forms.[156] The results showed persistent ambiguity aversion around the middle of the probability range (i.e., fifty percent) but not for very low probabilities (i.e., five percent),[157] with a resulting underestimation by participants of their likelihood of winning the auction as a result.[158] Other studies document the likely effects of ambiguity aversion in real-world settings ranging from the acceptance rates of economics articles by the American Economic Review, through investors' global preference for home-country

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150. In fact, recent studies also suggest that irrespective of their aversion to comparative ambiguity, decisionmakers also discount the value of information about economic events. *See* Eric Van Dijk & Marcel Zeelenberg, *The Discounting of Ambiguous Information in Economic Decision Making*, 16 J. BEHAV. DECISION MAKING 341 (2003) (showing this effect for ambiguity regarding past sunk costs, future potential, and future costs).

151. *See id.* at 150.

152. Selwyn W. Becker & Fred O. Brownson, *What Price Ambiguity? Or the Role of Ambiguity in Decision-Making*, 72 J. POL. ECON. 62 (1964) (discussing this example, which provided the first systematic examination of the ambiguity aversion following its famous original introduction by Daniel Ellsberg, *Risk, Ambiguity, and the Savage Axioms*, 75 Q.J. ECON. 643 (1961)).

153. *See generally* Camerer, *supra* note 148, at 646.

154. *See* Barbara E. Kahn & Rakesh K. Sarin, *Modeling Ambiguity in Decisions Under Uncertainty*, 15 J. CONSUMER RES. 265 (1988) (suggesting their findings show a reflection effect for gains/loss resembling that found for risk). *But see* Shawn P. Curley & J. Frank Yates, *The Center and Range of the Probability Interval as Factors Affecting Ambiguity Preferences*, 36 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 273 (1985) (finding that ambiguity avoidance increases with an increase in the center value of the probability interval, but no evidence for systematic ambiguity seeking); Joanna L.Y. Ho et al., *Effects of Outcome and Probabilistic Ambiguity on Managerial Choices*, 24 J. RISK & UNCERTAINTY 47 (2002) (finding this pattern only where outcomes, but not probabilities, were ambiguous, with the reflection effect in losses under ambiguous probabilities occurring only where the ambiguous and unambiguous probabilities were very close to one another).

155. Rakesh K. Sarin & Martin Weber, *Effects of Ambiguity in Market Experiments*, 39 MGMT. SCI. 602 (1993).

156. *Id.* at 603.

157. *Id.* at 610-11.

158. Ahti A. Salo & Martin Weber, *Ambiguity Aversion in First-Price Sealed-Bid Auctions*, 11 J. RISK & UNCERTAINTY 123 (1995).

investments at the cost of some foregone diversification, to the pricing decisions of insurance professionals.[159]

The notion of competence is one of the leading explanations for the gap between decisionmakers' probability judgments and their willingness to pay based on these judgments where ambiguity aversion occurs.[160] In a set of experiments, Heath and Tversky have shown that participants' preferences for betting on their ambiguous, real-world knowledge versus betting on a known chance outcome, depend on whether they feel especially competent or knowledgeable about the relevant events.[161] For example, participants who were pre-selected for their knowledge of politics and lack of knowledge of football, preferred to bet on political events rather than on chance events that they considered equally probable, but showed the opposite preference for betting on sporting events.[162]

These findings and further research show that ambiguity aversion vis-à-vis real-world events is driven by feelings of incompetence.[163] Such feelings are important when decisionmakers need to compare to one another two or more events about which they have different levels of knowledge.[164] Apparently, the contrast between the different levels of knowledge makes the less familiar bet less attractive under joint evaluation.[165]

Furthermore, the comparative ignorance underlying ambiguity aversion, according to this account, depends on decisionmakers' subjective state of mind.[166] This ignorance is not a function of the objective degree of knowledge possessed by the actor but a function of a reluctance to act on what is believed to be inferior knowledge. This inferiority can be brought to mind either by a comparison with one's superior knowledge about other events or domains or by a comparison with other people who appear more knowledgeable.[167]

Unsurprisingly, therefore, context variables that concern the comparison between the decisionmaker and relevant others affect the degree of ambiguity aversion exhibited by the former. For instance, a recent study found that people are sensitive to the relative competence of their counterpart when

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159. *See* Camerer, *supra* note 148, at 649 (reviewing these and related findings).

160. *See* Chip Heath & Amos Tversky, *Preference and Belief: Ambiguity and Competence in Choice Under Uncertainty*, 4 J. RISK & UNCERTAINTY 5 (1991).

161. *Id.* at 7.

162. *Id.* at 13-15 (similarly finding a comparable pattern for participants with high knowledge of football and low knowledge of politics); Craig R. Fox & Amos Tversky, *Ambiguity Aversion and Comparative Ignorance*, 110 Q.J. ECON. 585, 587 (1995).

163. Heath & Tversky, *supra* note 160; Fox & Tversky, *supra* note 162.

164. Fox & Tversky, *supra* note 162, at 587.

165. *See id.* at 585, 587. Decisionmakers may still be ambiguity averse under some circumstances, if less so, for separately evaluated events. *See, e.g.*, Sarin & Weber, *supra* note 155 (finding a much higher discrepancy between clear and vague bets in joint as compared to separate markets).

166. *See* Craig R. Fox & Martin Weber, *Ambiguity Aversion, Comparative Ignorance, and Decision Context*, 88 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 476 (2002), *available at* http://www.cebiz.org//cds/fox_weber.pdf.

167. *See id.* (emphasizing that "comparative ignorance" refers to the decisionmaker's state of mind); Fox & Tversky, *supra* note 162, at 587.

playing a simple competitive game ("matching pennies. However, this same study also found that people are not sensitive to their relative competence of their counterpart when playing a noncompetitive game.[168]

Taken together, the findings on ambiguity aversion suggest that rivals may choose to sacrifice a measure of expected value to avoid the ambiguous course of action of a novel information sharing arrangement. Moreover, the inevitable comparison between current, familiar practices—with regard to which they are likely to feel far more competent—and the ambiguous prospects of information sharing is bound to enhance competitors' aversion to the latter course of action.

Finally, as if the clear contrast between the extant practices and the prospective arrangement were not enough, the fundamentally competitive relationship between market rivals contributes to another comparison—between the rivals' relative competences. In the absence of any strategic threat or asymmetric information, such a comparison might have attenuated the competitors' aversion to ambiguity, insofar as they would tend to believe in their relatively superior competence.[169] Nevertheless, the sense of comparative ignorance underlying ambiguity aversion depends on one's perceptions of relative task knowledge, as opposed to an abstract, generalized notion of competence or skill. Here, therefore, where the future of an information sharing arrangement depends greatly on the other party's private knowledge and strategic intentions—because of economic factors such as the fear of degradation—rivals are likely to perceive themselves as comparatively ignorant and therefore be more reluctant to embark on the arrangement.

VI. THE MANIFESTATION OF IMPEDIMENTS TO INFORMATION SHARING IN DIFFERENT MARKET SETTINGS

Taken together, the analyses in this Article reveal that both economic and behavioral impediments to information sharing are of greater concern than previously thought. These impediments' presence may well spell a substantial social loss and can cause especially significant and unfortunate consequences. In critical infrastructure industries, for example, impediments to information sharing may cause the maintenance of security vulnerabilities that can be both harmful and costly to society at large.[170]

In general, the operation of economic and behavioral impediments indicates that, on their own initiative, competing rivals will not always develop

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168. Fox & Weber, *supra* note 166.

169. *See supra* notes 112-11 (discussing the evidence on managers' illusion of control), 125 (stating that competition enhances the illusion of control) and accompanying text. *See also The Fable of Entry*, *supra* note 17, at 505-08 (reviewing the evidence on decisionmakers' overestimations of their ability, skill, and performance).

170. *See, e.g.*, Emily Frye, *Information-Sharing Hangups: Is Antitrust Just a Cover?*, 1 CIP Rep. 6, 6-7 (2003); John McCarthy, *Focus on Information Sharing*, 1 CIP Rep. 1, 1 (2003), *available at* http://techcenter.gmu.edu/programs/cipp/cip_report/cip_report_1.8.pdf (both discussing the importance of information sharing and the costs of a lack thereof in critical infrastructures).

an information sharing arrangement whenever it would be socially beneficial to do so.[171] Nor will they even always embark on such an arrangement whenever it is privately beneficial for them to do so. Nonetheless, impediments to information sharing do not exert a uniform impact across the whole range of market settings, since the underlying circumstances that generate a given barrier may simultaneously either diminish or reinforce the significance of another.

Those purely economic impediments impact hypothetical, strictly rational competitors differently, depending on the expected private benefits and costs of information sharing in different circumstances. Similarly, real-life, boundedly rational competitors should not be expected always to face identical impediments to information sharing either. After all, one of the most fundamental insights of the behavioral literature is that human judgment and decisionmaking is context-dependent to a greater degree than analyses based on rational actor assumptions recognize.[172]

The following sections, therefore, begin charting the main factors that determine the impact of various impediments in different circumstances. Throughout this process, we also note the occasions where different impediments tend to interact and affect one another.

A. Economic Impediments

The market structure and industry characteristics in any given case of potential information exchange dictate both the likelihood and the severity of free riding and degradation problems. The risk of free riding is significant when the relevant information exhibits the characteristics of a public good.[173] This will be the case, in particular, when the information is not entirely excludable—that is, when the owner of the information cannot increase the cost of obtaining the information to a level above the value of the information to those in pursuit of the information. Hence, the more difficult

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171. *See* Frye, *supra* note 170.

172. For a more detailed discussion and some applications of this point, see *The Fable of Entry*, *supra* note 17, at 565-67. *See also* Robert A. Prentice, *Chicago Man, K-T Man, and the Future of Behavioral Law and Economics*, 56 VAND. L. REV. (forthcoming 2003) (asserting that the analyses of many scholars using a behavioral approach to law and economics have been taking into account behavioral differences between different legal actors); Jeffrey J. Rachlinski, *The "New" Law and Psychology: A Reply to Critics, Skeptics, and Cautious Supporters*, 85 CORNELL L. REV. 739, 743-44 (2000) ("Studying the effect of context has long been a part of psychology in general and [behavioral decision theory] in particular. It is a core principle of psychological research that understanding a phenomenon requires understanding when the phenomenon will occur and when it will not." (footnote omitted)). *But see* Gregory Mitchell, *Why Law and Economics' Perfect Rationality Should Not Be Traded for Behavioral Law and Economics' Equal Incompetence*, 91 GEO. L.J. 67 (2002) [hereinafter *Equal Incompetence*] (arguing that legal scholars apply behavioral findings without regard to their differential impact on different actors); Gregory Mitchell, *Tendencies Versus Boundaries: Levels of Generality in Behavioral Law and Economics*, 56 VAND. L. REV. (forthcoming 2003) (offering a more modest and nuanced version of the above argument).

173. *See, e.g.*, Lars H. Liebeler, *Trademark Law, Economics, and Grey-Market Policy*, 62 IND. L.J. 753, 755 n.13 (1986) ("Free-riding is most likely to occur when an organization provides a collective benefit to its members.").

the owner of information finds it to exclude others from obtaining it, the more likely will free riding take place. Limited excludability may result from a lack of intellectual property rights, from the high costs of enforcing such rights, or from the ease of obtaining the information without the consent of the owner (e.g., when the information is revealed by the information owner's actions or by inexpensive reverse engineering).

On the other hand, degradation is more likely where the information that could be shared is more excludable (i.e., the owner may increase the cost for others to obtain the information)[174] and where the consumption of the information by others is more rivalrous. For the rivalrous quality to exist, two conditions must be satisfied. First, a significant rival or potential rival must exist. Therefore, the relevant industry must include at least one rival or potential rival to the owner of the information,[175] with sufficient market power to affect the owner of the information.[176] The first condition is typically satisfied in those common oligopolistic markets. Second, there must be a relative disadvantage from reciprocal information sharing with that rival, where the benefit to one from receiving its rival's information is lower than the benefit to the rival from receiving one's information. This will happen, for instance, where the benefit from exchanging information that enhances cyber-security is greater for one bank that provides many online banking services than it is to its counterpart, which provides services mainly by "brick and mortar" facilities.

Which industries are more vulnerable to degradation? Because information sharing (like other forms of coordination) tends to be more essential in network environments,[177] depriving a rival of information through degradation is likely to have a substantial effect in such industries. Of course, an information exchange is meaningful only when different entities control segments of the industry. If, in contrast, the network environment consists of a single firm (e.g., a network industry controlled by the government), of course degradation would make no sense.

Degradation is also infeasible when the network environment resembles perfect competition—that is, where it consists of numerous tiny firms, none of which are able to impact the market by its actions (i.e., each is a "price taker").[178] In such a market structure, strategic behavior is irrelevant since

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174. If the information is entirely non-excludable, then the owner of the information cannot degrade even if she finds it profitable to do so. This limit to the possibility of degradation, however, will be taken into account *ex ante* by the potential owner, resulting in the free rider problem discussed above.

175. Even a monopolist might find it rational to degrade if a firm that currently does not participate in the market (perhaps because its production costs are supra-marginal) could become an effective competitor once it implements the shared information. Therefore, potential competitors may be sufficient for a firm to justify a strategy of degradation.

176. This condition will also be met if the rival will only have sufficient power pursuant to its acquiring the information.

177. *See, e.g.*, Carlton & Klamer, *supra* note 1, at 457; Lichtman, *supra* note 2, at 620-23.

178. *See, e.g.*, DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 86-88 (2d ed. 1994) (noting that models of perfect competition typically have a large number of sellers and buyers).

each individual firm can only respond to the market, not impact it. It makes little sense to incur costs in depriving information to an insignificant small rival, unless the small rival can divulge the information to a larger rival whose actions impact the market. In an industry that is composed solely of small firms, where no such larger competitor exists, there is no reason for degradation.

Nonetheless, many markets that are susceptible to degradation exist between the extremes of absolute monopoly and perfect competition.[179] Most often, these markets are oligopolies,[180] in which differentiated firms have some idiosyncratic advantages and disadvantages vis-à-vis their rivals. Degradation could then effectively be used to exploit one firm's relative advantages over its competitors.

Certain critical infrastructure industries, notably the energy, transportation, communications, and financial sectors, share these market characteristics: They are network industries; control over activity in the industry is private; there are some significant firms in the industry, but their number is not large; and often, these firms differ in size, cost structures, and other pertinent characteristics.[181] As a result of these characteristics, there are many instances in which one firm can find it advantageous to refrain from sharing information with its rival, in order to gain or maintain a competitive advantage vis-à-vis that rival. In these cases, which resemble our example of prospective cyber-security information sharing between two banks, because rival firms significantly diverge in the utility that they stand to gain from information exchange, these firms may decline even a mutually beneficial exchange.

In sum, while both economic barriers—of free riding and degradation—may significantly impede information sharing among competitors, the barriers' most severe manifestations are unlikely to occur in the same market settings. Where the relevant information is less excludable, free riding is a greater threat, while in those circumstances where the information is more excludable, degradation emerges as a more significant concern. Similarly, where information is non-rivalrous, there is little risk of degradation; as the conditions of the market make the relevant information become more rivalrous, however, the impediment imposed by degradation increases its significance.

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179. *See* Aviram, *supra* note 49 (manuscript at 38-45).

180. *See id.* (manuscript at 29-30) (discussing market structures in which degradation is likely).

181. *See, e.g.*, Robert B. Ahdieh, *Making Markets: Network Effects and the Role of Law in the Creation of Strong Securities Markets*, 76 S. CAL. L. REV. 277 (2003) (analyzing the securities exchange sector as a network industry); Carlton & Klamer, *supra* note 1, at 454-64 (analyzing the railroad, telephone, and electronic fund transfer industries as network industries); *The National Strategy*, *supra* note 10, at 8 ("Private industry owns and operates approximately 85 percent of our critical infrastructures and key assets.").

B. Behavioral Impediments

Much like the purely economic impediments, the impact of the behavioral impediments to information sharing also depends on the nature of the market and the relevant information in any given setting. Such market and information characteristics will exert a direct behavioral impact on competitors as well as erect economic impediments that, in turn, interact with some of the behavioral phenomena.

Norms of rivalry, for instance, are likely to be more intense and therefore impede information sharing to a greater degree in sufficiently concentrated markets, where rivals continually and repeatedly battle with one another. These norms may also exert some lesser impact in more competitive markets, but the lack of specific past rivalry will typically diminish their effect. On the other hand, in industries with a history of cooperation or collusion among rivals, or in the case of rivals with extant business collaborations, the identification of a mutually beneficial information sharing opportunity will be less affected by rivalry norms.[182]

A past or present cooperative or collusive relationship among competitors may also attenuate the effect of the illusion of control on managers' judgments, leading the latter to perceive the risks involved in information sharing as more controllable. Such a positive collaborative experience likely will lead competitors to view prospective arrangements more positively, diminishing the overestimation of risks and underestimation of benefits involved in information sharing with rivals, due to the affect heuristic.[183]

Nevertheless, the impact of risk attitudes will probably only be attenuated, rather than totally eliminated, especially where there is a risk of free riding or where the information is rivalrous. Free riding, after all, is the prototypical uncontrollable risk that the competitor owning the information is likely to perceive as more threatening than the "controllable" risks faced in the daily management of one's business.[184] In the same vein, the sharing of rivalrous information raises the risk of degradation, whose materialization depends on the decisions of one's rivals. These decisions, however, appear as much more "uncontrollable" than the diffuse and faceless risks of competition in the market.[185]

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182. This will also be the case, for example, where current competitors have recently belonged to the same corporate entity, such as when a company spins off a subsidiary or where the courts have ordered the divestiture of a monopolist or merging firms.

183. *See supra* notes 117-21 and accompanying text.

184. *Cf.* Avishalom Tor, Behavioral Analysis of Antitrust Law: The Case of Resale Price Maintenance 123-24 nn.293-99 (May 1998) (unpublished manuscript, on file with author) (arguing that the illusion of control contributes to upstream managers' tendency to overestimate the risks of free riding by discounting retailers as compared to those involved in controlling retail prices by means of resale price maintenance).

185. There is also empirical evidence that decisionmakers in competitive settings tend to leave the impact of the decisions of their counterparts out of focus, as long as this impact is "indirect"—meaning that the competitor's decision does not directly determine the actor's outcomes. *See* Tor & Bazerman, *supra* note 142; *The Fable of Entry*, *supra* note 17, at 517-20 (summarizing the findings of the above study and using them to explain why entrants overestimate the attractiveness of prospective *non-*

Past experience with other collaborative ventures (pro- and anti-competitive alike) can also diminish the ambiguity competitors associate with limited information sharing. As explained above, the effect of ambiguity aversion on decisionmakers' preferences is comparative—that is, depending on their subjective perceptions of competence and knowledge regarding the different choices they have.[186] Consequently, successful past collaborations will reduce the comparatively greater ambiguity typically associated with prospective information sharing, leading in turn to a reduction in competitors' reluctance to embark on such an arrangement.

Furthermore, recent evidence on ambiguity aversion also suggests that the parties' perceptions of whether the overall interaction between them is competitive or cooperative can determine their concern with their competence vis-à-vis their counterparts.[187] The more the parties will be inclined to view their relationship as cooperative, the less they will be concerned about their relative competence.[188] In this way, therefore, successful past collaboration may operate to reduce the impediment of ambiguity aversion with regard to the comparison between both the no-sharing and sharing options and the competitors' relative competences.

While successful past collaboration may diminish the impact of ambiguity aversion, however, the fear of degradation is likely to exacerbate the effect of this barrier. This exacerbation is prone to occur because the possibility of degradation—which arises only where the relevant information is rivalrous—means that the competitors' relative competences are directly pitted against one another. The competitors' awareness of the idiosyncratic advantages and disadvantages they have with regard to information sharing will thus be heightened, resulting in an increased ambiguity aversion.

Finally, and unlike many of the other behavioral impediments to information sharing, the status quo bias will typically be less affected by past collusion or other collaborative experiences.[189] We have seen that this bias results from both the prevalent aversion to losses from the status quo reference point and the asymmetry between action and inaction.[190] Loss aversion is likely to exert its biasing effect regardless of past history, since the pre-

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collaborative ventures).

186. *See, e.g.*, Fox & Tversky, *supra* note 162; Fox & Weber, *supra* note 166; Heath & Tversky, *supra* note 160.

187. *See* Fox & Weber, *supra* note 166 and accompanying text.

188. *See id.*

189. While the status quo bias tends to be robust across different market settings and industry conditions, there will be some narrow settings that may diminish or even eliminate it. To wit, there is some evidence that reference points other than status quo can impact choice. For example, when decisionmakers are driven by a particular goal or aspiration, they may use these as reference points and view an outcome that is above the status quo but below these points as failure to which they will be loss averse. *E.g.*, Chip Heath et al., *Goals as Reference Points*, 38 COGNITIVE PSYCHOL. 79 (1999). Under these limited circumstances, competitors may exhibit risk seeking (the byproduct of loss aversion) instead of the typical risk aversion for outcomes above the status quo.

190. *See supra* notes 126-44 and accompanying text.

sent status quo will still be for each rival to continue vying for the greatest competitive success without any collaboration with its counterpart.[191]

Similarly, embarking on a new information sharing arrangement will commonly involve action, while avoiding it typically will not. This asymmetry will usually remain as long as the current state of affairs is competitive. Therefore, the asymmetry may help sustain the status quo bias, even in the face of past interactions. In some limited circumstances, however, omission biases will not reinforce the status quo barrier to information sharing where the sharing of information can occur without any overt action on the part of its owner. For instance, where the information is non-excludable and free riding is likely to take place, omission biases will not reinforce the status quo but rather diminish its inhibiting effect on information sharing. Nevertheless, in those more common settings where the establishment of an information sharing arrangement requires action on the part of competitors and where the information is more excludable and rivalrous, the omission bias will join loss aversion in impeding a move away from the no-sharing status quo.

VII. OVERCOMING IMPEDIMENTS TO INFORMATION SHARING

The problems we addressed in this Article may sometimes be mitigated. Mitigation strategies for information under-sharing, however, are not only of limited efficacy, but also usually require a trade-off between promoting beneficial information sharing and increasing the ease of collusion.

A. Private Legal Systems as a Means to Overcome Impediments to Information Sharing

With regard to the one economic impediment to information sharing that the literature has already recognized—namely, free riding—the solution lies in overcoming a collective action problem: Firms may forego free riding on others' information in return for protection from free riding on their own information. For example, in return for being paid to provide information, these firms would be willing to pay for the information that they receive. However, such reciprocity is not self-enforcing,[192] and its external enforcement usually requires costly collective action.[193]

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191. The most obvious exception to this rule would be, of course, when competitors are already cooperating. In fact, where such cooperation is sufficiently significant—as in the case of a cartel—the status quo bias will typically exert the opposite effect, contributing to the maintenance of the cartel. *See* Developing a Behavioral Approach, *supra* note 17 (manuscript at 45-50).

192. At least, it is not self-enforcing among self-interested rational actors, although it may sometimes be self-enforcing among real individuals. *See* Dan M. Kahan, *Trust, Collective Action, and Law*, 81 B.U. L. REV. 333, 333-34 (2001). According to Kahan:

> In collective action settings, individuals behave not in the materially calculating fashion characteristic of *homo economicus* but rather in the richer, more emotionally nuanced fashion . . . . When they perceive that others are behaving cooperatively, individuals are moved by honor,

Nevertheless, the literature has identified institutions that solve or mitigate collective action problems.[194] Scholars describe, for example, how merchant coalitions of Maghribi traders in the Middle Ages enabled these merchants to share information efficiently on the honesty of agents and enforce such honesty.[195] Similar institutions, or private legal systems, may be able to mitigate the economic impediment of degradation by detecting the possession of information by one competitor and policing its disclosure to others.

However, there are some limitations to such institutions. First, they are unlikely to form spontaneously, because enforcement costs would be high and the newly formed institution would not have any sanction with which to threaten firms that fail to obey.[196] To possess such sanctions, the institution would need to rely on pre-existing networks, whose membership overlaps with that of the group that is to be regulated (i.e., the firms that want to share information) and which provide their membership with services that are less costly to enforce (such as social utility).[197] Thus, since it is difficult to artificially create such networks, membership in the information sharing group needs to be structured in a way that would mimic the membership in a pre-existing network.[198]

> altruism, and like dispositions to contribute to public goods even without the inducement of material incentives.

Id. In the present case, however, behavioral forces typically increase, rather than decrease, the severity of collective action, because of the intense rivalry among competitors. *Cf. id.* ("When, in contrast, [real individuals] perceive that others are shirking or otherwise taking advantage of them, individuals are moved by resentment and pride to retaliate. In that circumstance, they will withhold beneficial forms of cooperation even if doing so exposes them to significant material disadvantage.").

193. *See* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOALS AND THE THEORY OF GROUPS 1-2 (1965) (stating that in the original formulation of the problem, "[u]nless there is coercion or some other special device to make individuals act in their common interest, rational, self-interested individuals will not act to achieve their common or group interests."). *See also* Kahan, *supra* note 192, at 333. Kahan summarizes the collective action account as follows:

> Absent externally imposed incentives, rational individuals, he argued, will rarely find it in their interest to contribute to goods that benefit the group as a whole, but rather will "free ride" on the contributions that other group members make. As a result, too few individuals will contribute sufficiently, and the well-being of the group will suffer.

Id.

194. *See, e.g.*, Robert O. Keohane, *Rational Choice Theory and International Law: Insights and Limitations*, 31 J. LEGAL STUD. 307, 313 (2002) ("Institutions, including legal institutions, may be invented in order to solve collective action problems by reducing transaction costs, providing information, and increasing the credibility of commitments.").

195. *See* Avner Greif, *Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition*, 83 AM. ECON. REV. 525 (1993).

196. *See* Aviram, *supra* note 68, at 9-21.

197. *See id.* at 21-26.

198. The Information Sharing and Analysis Centers ("ISACs"), which Presidential Decision Directive 63 envisioned as a key institution in facilitating information exchange among private owners and operators of critical infrastructure, provide a significant case on point. *See* Critical Infrastructure Assurance Office, *The Clinton Administration's Policy On Critical Infrastructure Protection: Presidential Decision Directive 63* (1998), *at* http://www.ciao.gov/resource/paper598.html (describing Presidential Decision Directive 63, which is classified). So far, existing ISACs have been delineated by industry (broadly defined), including Financial Services, Chemicals Industry, Electric Power, Emergency Fire Services, Emergency Law Enforcement, Food, Information Technology, Interstate, Oil & Gas, Surface Transportation, Telecommunications and Water Supply, and have enjoyed mixed success. *See* McCarthy, *supra* note 170, at 4. *See also* Frye, *supra* note 170 (arguing that antitrust liability is unlikely in most circumstances, and that a better explanation for the limited information sharing among ISAC

A second limitation to private legal systems is their inability to deal with degradation that exploits vulnerability to network effects. Contrast the banks and telephone companies examples we used to illustrate the problem of degradation in Part III. In the banks example, Bank B exploited Bank A's greater vulnerability to cyber-security threats. If both banks were members in a network that provides not only cyber-security protection but also other benefits (e.g., interchange of ATM transactions so that a client of each bank can use the ATM of any member of the network), then the network could threaten Bank B that if it does not share information on cyber-security, it would be expelled from the network and its clients would lose the ability to use the ATMs of all the other banks. This may deter Bank B from declining to share information.

In the case of the telephone companies, on the other hand, the larger Goliath made it less vulnerable than the smaller David to the static noise on the shared network. Threatening Goliath with expulsion would therefore not deter it. In fact, Goliath may want to be expelled, so that customers of David and the other phone companies with a combined market share of thirty percent would not be able to call the customers of Goliath (who comprise seventy percent of the market), and thus would migrate to Goliath. Apparently, when degradation exploits vulnerability to network effects, private legal systems based on networks are usually ineffective in reigning it in,[199] and even governmental regulation faces significant difficulties in detecting such behavior.[200]

A third limitation to the efficacy of institutions that attempt to overcome degradation (or free riding) is the trade-off between the benefits of efficient information sharing and the costs of collusion. The same institutions that increase the ability to share information on efficient production processes also increase the ability to collude over prices, quality, territory, etc. From the firms' perspective, both gains from more efficient production and gains from collusion are equally welcome.[201] In fact, since degradation stems from the firms' fear of competition from their rivals, private legal systems may be tempted to solve the problem not by forcing firms efficiently to share information despite this fear, but by quenching the very competition that creates the incentive to degrade. Just as solutions that reduce sabotage among coworkers result in a reduced incentive for each employee to ex-

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members is lack of trust among them). Part of the reason for the difficulty that ISACs have in facilitating information exchange may lie in their inability to overcome the degradation problem in the absence of a pre-existing network that encompasses all of the ISAC members. The ISAC case therefore demonstrates that private legal systems may only alleviate the problem of degradation among certain groups and only if the information exchange is limited to those groups.

199. *See* Aviram, *supra* note 49 (manuscript at 44-48) (describing the lesser effectiveness a private legal system's enforcement mechanisms have in regulating acts of degradation).

200. *See id.* (manuscript at 28-29) (describing the difficulties in detecting act of degradation or even defining what acts would consist of degradation).

201. This would only be true insofar as there are no legal costs to collusion. In any case, however, illegal collusion that is hard to detect and to convincingly prove leads to similar outcomes after the limited legal costs are taken into account.

cel,[202] so do degradation solutions risk a reduction in firms' incentives to compete as vigorously against each other.

In addition to facing the various limitations described here, any institution that seeks to address the problem of under-sharing information among competitors must also overcome the behavioral barriers to such arrangements. The behavioral findings described above support the conclusion that facilitating institutions are unlikely to develop spontaneously, since their development will be inhibited by some of the behavioral factors that impede information sharing. Thus, rivalry norms will make competitors less likely to recognize the advantages of impediment-overcoming institutions and the biasing power of the status quo and ambiguity aversion will inhibit their creation even where some of the benefits of these institutions are recognized.

On those few occasions where a pre-existing private legal system can provide the basis for an information sharing arrangement, its members will also be aware that norms of cooperation may well apply. In this setting, rivalry norms will be unlikely to slow down competitors' recognition of a profitable information sharing opportunity, but they will also not inhibit their ability to realize the benefits of, say, anticompetitive price coordination.

Similarly, a well functioning institution that effectively monitors the relevant activities of its members, that has the ability to sanction them, and that is one in which no member has disproportionate power over institutional decisions, may help alleviate managers' biased perceptions of the risks and benefits of information sharing. The presence of such an efficacious institution, however, will not only be rare but also lead competitors to avoid a downward bias in judgments of collusive opportunities, increasing their inclination to engage in anticompetitive behaviors.

The behavioral impediments in the domain of choice, on the other hand, will benefit less from a reliance on pre-existing private legal systems in that they will still be likely to impede both information sharing and collusive behavior, if to a more limited degree. The status quo bias will probably not be eliminated where private legal systems are present, since insofar as information sharing is concerned, competitive decisionmaking will provide the reference point and generate loss aversion.[203]

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202. *See* Chen, *supra* note 54, at 134-37 (suggesting strategies for alleviating the impact of sabotage among coworkers, and assessing the trade-offs of each strategy).

203. Only where the pre-existing institution applies to such a broad range of activities that competition appears to be the exception instead of the rule will the status quo bias promote (rather than inhibit) information sharing. Such occasions, however, will obviously be exceptionally rare and do not provide a meaningful solution for the problem of under-sharing. In addition, as in the case of the judgments impediments discussed above, the limited settings where broad collaboration is the rule inevitably promotes collusion as well.

B. Governmental Intervention to Overcome Impediments to Information Sharing

External governmental intervention—whether a direct provision of incentives or an indirect facilitation of information sharing—may be able to overcome some of the impediments examined here. These attempts, however, will typically be successful only to a limited degree and often (as has been the case with private institutions) at the cost of making anticompetitive collusion among these parties more likely as well. Furthermore, any attempt at the governmental facilitation of information sharing will also generate additional costs because of the need to detect those markets and circumstances where such arrangements are socially beneficial and due to the significant costs involved in the facilitation itself.[204]

These problems are likely to be especially severe where the direct provision of financial incentives to competitors—which would make information sharing an attractive prospect despite, say, a risk of degradation—is concerned. For instance, the direct provision of incentives would require the government not only to identify circumstances where socially beneficial information sharing is impeded, but also to determine the magnitude of the social loss, as well as the magnitude of incentives necessary to overcome the barriers. Otherwise, there will be no telling whether external intervention is at all justified. Both of these determinations, however, are very difficult and costly to arrive at with any accuracy.

In principle, financial incentives may also be used to overcome the behavioral impediments to information sharing.[205] After all, the effect of these behavioral barriers is not completely to prevent information sharing but, instead, to make it less likely to happen. Competitors' difficulty of identifying objectively profitable opportunities for sharing information, or overestimates of the risks and costs and underestimates of the benefits of such arrangements, only imply that their expected benefits must be significantly larger than those strictly rational rivals would have required before they decided to share information. Similarly, the strong preference of boundedly rational competitors for the status quo, or for avoiding choosing comparatively more ambiguous options, only implies that they will demand far

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204. Any governmental operation may be subject to a variety of problems and inefficiencies, which have been discussed in some detail in the public choice literature and which are only exacerbated by the complexity and uncertainty involving economic interactions in markets. *See, e.g.*, *The Fable of Entry*, *supra* note 17, at 546-47 & n.269 (citing additional sources and briefly discussing the similar problem with regard to the more extreme possibility of regulating overconfident entry, with special reference to regulation in the face of boundedly rational behavior).

205. In this case, the role of financial incentives is not to debias, for example, competitors' mistaken judgments of the attractiveness of information sharing, but rather to take the bias as given and simply make the arrangement subjectively more attractive. As a recent review of the empirical literature suggests, the former attempt would not be effective. *See* Colin F. Camerer & Robin M. Hogarth, *The Effects of Financial Incentives in Experiments: A Review and Capital-Labor-Production Framework*, http://www.hss.caltech.edu/SSPapers/wp1059.pdf, at 17 (noting that "all established anomalies have essentially survived" attempts to make them disappear by raising incentives, although incentives do tend to diminish the variance of participants (emphasis omitted)).

greater perceived benefits—in proportion to the perceived risks and costs—before they embark on a novel information sharing arrangement.[206]

Nevertheless, while the "stickiness" of competitors' behavior may be overcome by the provision of sufficiently great additional incentives, the high costs involved in these additional incentives will often make the intervention inefficient.[207] Only in very limited circumstances—where the net social benefits from information sharing are dramatically larger than the private ones but these private benefits are still too small to overcome the various impediments without intervention—would providing competitors with large additional incentives be socially beneficial.

The provision of incentives may be of limited use in the case of information sharing, but where the information to be shared is easily defined, and failure to provide it is easily detected, the government may be able to mandate specific information exchanges. In other words, the government may replace private ordering in punishing degradation. An example of such regulation may be found in the Federal Energy Regulatory Commission's Order 497, which regulates information sharing among pipelines, as well as between pipelines and their affiliates.[208]

Governmental intervention in these circumstances may be crucial to mitigating degradation because private legal systems are at a disadvantage compared to the government in punishing degradation: The strongest private sanctions are typically based on exclusion from the network, yet a degrader would not be deterred by such sanction, since the very goal of degradation is reducing one's connection with the network.[209] Public sanctions, such as incarceration and fines, are better able to punish degradation.

On the other hand, however, the public enforcement mechanism (be it courts or regulatory agencies) typically does not have an advantage over private ordering in determining what consists degradation (i.e., what information cannot be withheld from competitors) and the detection of attempts of degradation.[210] Moreover, a vaguely defined governmental mandate for intervention in a broad range of market activities can be costly and problematic. Thus, a role for governmental intervention would be easier to justify in cases in which these latter issues are relatively clear or inexpensive to ascertain.

The government may also be an efficient regulator when degradation creates externalities that harm persons who are not constituents of the pri-

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206. For example, the average coefficient of loss aversion has been estimated at about 2 (i.e., a ratio of 2:1 for gains versus losses of equal magnitude) for small or moderate monetary gains and losses as well in some non-monetary settings, although various factors can increase or decrease this ratio. *See, e.g.*, Kahneman et al., *supra* note 20; Tversky & Kahneman, *supra* note 127.

207. Especially given the difficulties and costs involved even in providing incentives only to overcome those purely economic impediments to information sharing we discussed above.

208. *See* FERC Order No. 497, *supra* note 9. *See also* Tenneco Gas v. FERC, 969 F.2d 1187 (D.C. Cir. 1992) (explaining this order).

209. *See supra* text accompanying note 199. *See also* Aviram, *supra* note 49, manuscript at 53-55 (discussing this point in greater detail).

210. *See id.*

vate legal system, and for whose interests, therefore, the private legal system might not cater.[211] This may explain the Securities Exchange Commission's role in regulating disclosure of information on firms that issued securities to the public. A traded firm may often have an interest in keeping much information confidential, since its rivals could benefit from acquiring this information.[212] This nondisclosure, however, causes a negative externality on outside shareholders, whose shares' value is diminished due to the reduced accuracy of the market price, as well as by the risk that insiders may exploit their informational advantage. Thus, even if all firms were to overcome the collective action problem and agree on a standard for what information should be disclosed, they would not consider the full negative impact of withholding information on shareholders.[213] Forcing firms to internalize this externality may provide a role for government.[214]

Additionally, the government may be able to facilitate information sharing by setting the correct balance in the trade-off between degradation and collusion and thus, where appropriate, reducing competitors' incentives to engage in degradation. As we have explained above, degradation stems from the competition between the performer of the degradation and its victims. The government, through its control of competition laws and competition enforcement agencies, may opt for either a stricter or a more lenient enforcement of laws against collusion formed by information sharing. All else being equal, the stricter the enforcement, the greater the incentive to degrade; conversely, the more lenient the enforcement, the lower the incentive to degrade, but also the greater the likelihood that firms will collude. To the extent that government best internalizes the incentives of all stakeholders, it may be in the best position to determine the optimal trade-off between collusion and degradation and scale its enforcement efforts accordingly.[215]

When the impediment to information sharing is free riding rather than degradation, a subtler form of government intervention may take place. If the free riding impediment is caused by a difficulty for the firms involved to

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211. *See id.*

212. Whether or not such withholding of information is degradation depends on whether it is efficient from society's viewpoint to disclose the information (in which case, the withholding of information is a form of degradation).

213. Similarly, they would not take into account the negative impact of releasing information—to the extent this facilitates collusion—on consumers.

214. Some scholars believe that privately-owned stock exchanges consider the interests of minority shareholders (because the small shareholders would vote with their feet in favor of exchanges that regulated issuers in a way that protects minority shareholders). For a critique of this view (in the context of commodities exchanges), see Stephen Craig Pirrong, *The Self-Regulation of Commodity Exchanges: The Case of Market Manipulation*, 38 J.L. & ECON. 141 (1995). Even if exchanges do internalize small shareholders' interests, the private regulation of degradation by exchanges is still likely to face a relative disadvantage (compared to public enforcement) in punishing degradation.

215. This is not to say that there is always a trade-off between collusion and degradation. Sometimes, more lenient antitrust enforcement would allow (welfare-reducing) collusion while not resulting in less degradation. This is because either there is no significant incentive for degradation or degradation is more costly to the would-be degrader than the benefits she would derive from it. In such cases, strict enforcement of antitrust laws would not increase the likelihood of degradation.

agree on a specific standard for information sharing, government may narrow the range of possible standards to ease the convergence of firms to one standard, while still allowing firms to freely decide on the standard that is most suitable for them.[216] This can be done, for example, through the governmental formation of voluntary information sharing programs, with prearranged (but modifiable) rules of exchange. An effort in this direction is illustrated by the establishment of voluntary Information Sharing and Analysis Centers to mitigate threats to critical infrastructure.[217]

Finally, another, more broadly applicable, approach may sometimes be available for overcoming the behavioral barriers to information sharing, by addressing competitors' boundedly rational judgment and choice head-on in an attempt to align their subjective perceptions and preferences with the normative expectations of rational actor models.[218] For instance, overcoming norms of rivalry may be possible, since norms do appear to change over time and to be amenable—at least to some degree—to outside manipulation.[219] Interestingly, moreover, recent empirical evidence suggests that a successful norm manipulation may also diminish the inhibiting effect of ambiguity aversion on competitors' choice to share information.[220] Nevertheless, as with those institutions aimed at curbing the economic impediments, any intervention that turns successful in making partial cooperation among rivals—such as information sharing—more legitimate and acceptable will also tend to facilitate anticompetitive collusion among them.

Debiasing competitors' judgments of the risks and benefits of information sharing, on the other hand, is likely to prove a much harder task. In fact, the limited evidence reveals that successful debiasing is uncommon and typically requires intensive interventions that are irrelevant in the present

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216. *See, e.g.*, Robert B. Ahdieh, *Law's Signal: A Cueing Theory of Law in Market Transition*, 77 S. CAL. L. REV. (forthcoming 2003) (discussing law's role in signaling preferred alternatives and thus narrowing options to reduce the cost to private parties of solving "Meeting Place" types of interaction problems).

217. *Supra* note 197.

218. Of course, unlike a solution based on providing greater financial incentives, this approach can, at best, only overcome the behavioral but not the economic barriers to information sharing. In other words, seeking a solution to behavioral impediments, this approach attempts to impact competitors' subjective views of information sharing without changing the objective private benefits and costs of these arrangements.

219. *See, e.g.*, Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 733 (1999) (describing norm change by "availability entrepreneurs"); McAdams, *supra* note 93, at 391-408 (discussing norm change and the possibility of regulating norms); Sunstein, *supra* note 93, at 909, 929-30 (discussing mechanisms of norm change and how they can be used by "norm entrepreneurs").

220. *See* Fox & Weber, *supra* note 166, at 489-91 (finding ambiguity aversion with participants are sensitive to the relative competence of their counterpart when playing a simple competitive (matching pennies) game, but not when playing a noncompetitive (coordination) game that has the same mixed strategy Nash equilibrium). *See also* Colin F. Camerer & R. Karjalainen, *Ambiguity Aversion and Non-Additive Beliefs in Noncooperative Games: Experimental Evidence*, *in* MODELS AND EXPERIMENTS IN RISK AND RATIONALITY 325 (B. Munier & M. J. Machina eds., 1994) (finding that most respondents would rather bet on a chance device (e.g., the flip of a coin) than against the play of another person (e.g., one who faces a choice between two strategies with symmetrical consequences)).

case.[221] Similarly, outside intervention aimed at overcoming the biasing effect of the status quo may be difficult, given the status quo's natural role as a reference point.[222] However, insofar as an intervention can generate effective alternative reference points, for instance, by creating an environment where information is shared by default, it may be able to overcome or at least diminish the status quo bias. If such a complex endeavor were successful, the default setting could create a new reference point, and in any case make the no-sharing choice a commission instead of an omission, thus reducing the power of the no-sharing status quo.

In sum, our tentative exploration of possible means to overcome the economic and behavioral impediments to information sharing among competitors has revealed the myriad of difficulties and costs involved in this task. This is not to say, of course, that private legal systems or governmental arrangements will never be helpful in mitigating the social costs of sub-optimal information sharing, only that their ability to generate a social benefit is limited.

VIII. CONCLUSION

Information sharing may be a boon or a bane, depending on the circumstances. But whether it is good or ill, an assessment of the likelihood of information sharing is important for numerous areas of law and policy. The existing theoretical framework overstates the likelihood of information sharing in many circumstances because it ignores several important impediments to the sharing of information. In this Article we begin charting this new territory.

We started, in Part II, with a cause the literature has not neglected—the free rider (or collective action) problem. Part III then examined the problem of degradation—an economic constraint on information sharing that has yet to receive the literature's attention. While Parts II and III addressed phenomena that cause a divergence between the social and private cost-benefit calculus, however, the analysis in these Parts assumed that competitors would always opt to share information when the private benefits of such an arrangement outweigh its private costs. Parts IV and V, on the other hand, challenged this assumption, examining real-world behavioral phenomena that may cause firms to exhibit levels of information sharing that are even privately—not only socially—sub-optimal.

In Part IV we focused on managers' judgments, arguing that competitors will not recognize an opportunity for limited cooperation by information sharing as swiftly as extant models assume. The two main causes of this effect we have identified were, first, the persistence of rivalry norms;

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221. For a discussion of the difficulties involved in governmental interventions aimed to debias market participants, as well as in debiasing more generally, see *The Fable of Entry*, *supra* note 17, at nn.271-74 and accompanying text.

222. *See, e.g.*, Kahneman et al., *supra* note 20; Samuelson & Zeckhauser, *supra* note 134.

and second, an underestimation of the risks and costs of maintaining a purely competitive relationship as compared to those involved in embarking on a novel information sharing arrangement. Part V examined competitors' choice behavior, arguing that the status quo bias and comparative ambiguity aversion can lead market participants consciously to forego new profitable opportunities for limited cooperation, unless these opportunities' overall estimated value significantly—not just marginally—outweighs that of continuing the purely competitive status quo.

Building on the analysis in Parts II-V, we began in Part VI the task of integrating our insights regarding the various economic and behavioral barriers. The framework we started developing in this Part reveals how different impediments exert a more or less severe impact on information sharing in different settings. We also found that some of the factors that generate impediments to information sharing interact and reinforce one another under specific circumstances.

Finally, Part VII explored a variety of strategies that might help overcome barriers to information sharing. We examined the potential role of both private institutions and external governmental intervention. Our analysis showed that each of these sources of intervention, as well as the different means available to them, may be more effective than its counterpart in different circumstances. The analysis has also revealed circumstances where none of the available strategies is likely to be socially beneficial or efficacious; in these cases, therefore, the presence of impediments to information sharing must be taken into account as a given.

The insights of this Article have numerous legal and policy applications that merit further study, in antitrust law and well beyond. First, understanding the impact of sub-optimal information sharing is important for many areas of antitrust analysis, including horizontal mergers, joint ventures, and divestitures.[223] In all of these areas, an overstatement of the likelihood of information sharing among competitors can lead to an illegalization of, or the imposition of excessive restrictions on, some beneficial horizontal arrangements or transactions. Second, an analysis of sub-optimal information sharing is also central to the formulation of public policy regarding network industries and critical infrastructures more generally. Not only is the role of information sharing in such markets highly significant, but the importance of these industries for the vitality of the national economy can hardly be overstated.[224] And third, a more accurate assessment of the likelihood of information sharing may also advance the analysis of procedural rules, since the facilitation of information exchange is an important consideration in the shaping of the rules of pre-litigation discovery proceedings. Insofar as the extant scholarship overstates the likelihood of information exchange among litigants, the impediments to information sharing examined here may pro-

223. *See supra* notes 6-8.

224. *See supra* notes 9-10.

vide useful insights regarding proper scope of discovery and privilege, whose efficacy may currently be overstated.[225]

225. *See supra* notes 11-12.