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# Regulation by Networks

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## I. INTRODUCTION

Public and private regimes of behavior regulation coexist, in varying degrees of harmony, in many aspects of life.[1] Law, even under a narrow definition that excludes private regulatory regimes, known as Private Legal Systems (PLSs), must address the degree of accommodation public regulatory regimes will afford their private counterparts. Some fields of law—most notably contract and property law—enforce forms of private

1. The term "regulation" has a variety of definitions, some so broad as to encompass any constraint that limits free choice and others so narrow as to relate only to government activity that mandates consumer prices to firms in certain industries. Broadly speaking, regulation includes the creation of norms, detection of violations of those norms, and enforcement of the norms on the detected violators. To focus the discussion in this Article, the term "regulation" will be used to mean activity (by any institution or individual) aimed at enforcing norms. Often, regulation is facilitated through intervention of an entity other than the party that is potentially harmed by the violation of the norm. However, one form of regulation (which this Article will refer to as transaction regulation) involves mechanisms implemented by parties to the transaction with the intent to protect against violations of norms that regard the transaction. For example, forming long-term relationships with certain parties and abstaining from contracting with others would be considered a form of transaction regulation. Another form of regulation (referred to as self-regulation) involves self-restraint by the would-be norm violator. Regulation therefore spans a wide range of forms, from self-regulation by the potential norm violator, through parties that are potentially harmed by the violation of the norm and third-party "gatekeepers" that work on their behalf (*see infra* text accompanying note 29), to regulation by networks and, finally, to regulation by government.

regulation that are perceived as beneficial. Other fields of law—antitrust law in particular—prohibit forms of private regulation that are perceived as harmful.

Still other fields of law do not directly address private regulation, but may be designed in ways that either facilitate or hinder coexistence of public and private law in a given area. For example, imposing liability on private institutions that unknowingly facilitate illegal activity assists in preventing the illegal activity, but imposes an additional cost on the private entities. This issue has received much attention recently in connection with the media industry's attempt to impose liability for copyright violations on peer-to-peer exchanges (notably, Napster),[2] as well as regulators' attempts to impose liability on online payment systems that facilitate illegal gambling.[3] This liability may deter some efficient private schemes. The result may or may not be socially beneficial depending on the social benefits from the private scheme and their relative advantage or disadvantage over public counterparts.

The legal scholarship known as "private ordering" serves these bodies of law by assessing the social benefits and relative advantages of PLSs. In analyzing private institutions, this literature emphasizes two elements that are used to regulate or enforce norms:[4] repeated play and

2. *See* A&M Records, Inc. v. Napster, Inc., 239 F.3d 1004 (9th Cir. 2001) (finding that record companies and movie publishers made a prima facie case of copyright infringement against Napster, a peer-to-peer system for online exchange of files); Ellison v. Robertson, 189 F. Supp. 2d 1051 (C.D. Cal. 2002) (holding that the posting of copyrighted material on an America Online USENET newsgroup comes within the scope of the Digital Millennium Copyright Act's safe-harbor provision for "intermediate and transient storage").

3. *See, e.g.*, *PayPal Inc. to Stop Processing Payments from New Yorkers*, WALL ST. J., Aug. 22, 2002, at B8 (discussing the New York Attorney General's investigation of PayPal, Inc., an online payment system, for its involvement in processing payments related to online gambling activities).

4. Scholars offer a variety of definitions of the term "norms." *See, 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 that distinguish desirable and undesirable behavior while giving a third party the authority to punish those engaging in undesirable behavior); Lior J. Strahilevitz, *Social Norms from Close-Knit Groups to Loose-Knit Groups*, 70 U. CHI. L. REV. 359, 363 n.24 (defining norms as "behavioral regularities that arise when humans are interacting with each other, regardless of whether that interaction is face-to-face"); Cass R. Sunstein, *Social Norms and Social Roles*, 96 COLUM. L. REV. 903, 914 (1996) (using a rough definition of norms as

reputation. This Article discusses a third element: network effects. Network effects (or network benefits) are demand-side economies of scale—the phenomenon that the utility to a user of a good or service increases as additional people use it.[5] Often, though not always, realization of network effects requires interconnection between the users. The institution that facilitates interconnection between users of a good or service exhibiting network effects, thus enabling the realization of network benefits, is called a network.

While a significant literature exists on the economics of network effects and some scholars have discussed the application of network effects in legal analysis,[6] the private-ordering literature has for the most part ignored the implications of network effects. This is a significant shortcoming because the vast majority of PLSs examined in the literature are networks, such as exchanges, merchant coalitions, and social circles.

This Article will explore the implications of network effects on the ability and relative advantage of private institutions to regulate. While the analysis in this Article is applicable to the enforcement of any norm, the Article will focus on regulation as the mitigation of opportunistic behavior in transactions. The Article presents three insights on private ordering that are better understood through a network-effects analysis. First, network effects make certain mechanisms far more effective in enforcing norms. The Article classifies four such mechanisms commonly used by networks and assesses in which market structures they will be most effective. Second, network effects allow a certain type of opportunistic behavior (which this Article, following recent economic

"social attitudes of approval and disapproval, specifying what ought to be done and what ought not to be done"). Since this Article examines a spectrum of regulators (i.e., norm enforcers) that encompasses government as well as private actors and since the same "norm" may be enforced by one of several regulators depending, among other things, on the relative efficiency of each regulator in enforcing the specific norm, it is not sensible for this Article to use a definition that is based on the identity of the regulator (i.e., it is not sensible to call something a norm if a private actor enforces it but not if a government actor does). Therefore, this Article will take a very broad definition of norms, to include all rules and regularities concerning human conduct (including legal and organizational rules).

5. *See* discussion *infra* Part III.A.1.

6. *See, e.g.*, RICHARD A. POSNER, ANTITRUST LAW: AN ECONOMIC PERSPECTIVE 245–56 (2d ed. 2001) (analyzing exclusionary practices in the "new economy," which is characterized by significant network effects); David A. Balto, *Networks and Exclusivity: Antitrust Analysis to Promote Network Competition*, 7 GEO. MASON L. REV. 523 (1999); Mark A. Lemley & David McGowan, *Legal Implications of Network Economic Effects*, 86 CAL. L. REV. 479 (1998).

literature, calls "degradation")[7] that is not feasible to the opportunistic party in nonnetwork environments. Some norm-enforcing mechanisms that are commonly used against "garden-variety" opportunism are ineffective against degradation, making a regulator whose strengths lie in these mechanisms less efficient in enforcing norms if degradation is likely to occur. Third, networks are dynamic entities that evolve and change their form to seize opportunities that increase the networks' benefit to their members, such as increasing their ability or incentive to regulate.[8] The Article examines one such important dynamic:[9] the ability of networks to modify themselves so as to become more effective regulators when the existing network has the ability to regulate efficiently but not the incentive to do so.[10]

Part II of this Article examines regulation (i.e., norm-enforcing) in general. This part will introduce the reader to the problem that a regulator will face (opportunism), to the institutions that attempt to mitigate this problem, and to the elements that facilitate private ordering: repeated play, reputation, and network effects. Part III then looks in depth at how network effects influence regulation. It explains the nature and characteristics of network effects and then analyzes how network effects enhance the ability to regulate on one hand, yet create new and more powerful forms of opportunism on the other hand. On the regulation-enhancing side, four types of mechanisms used by networks to regulate are classified and discussed. On the opportunism-enhancing side, a network-effects-driven type of opportunism called degradation is explained and distinguished from the type of opportunism commonly addressed in the private-ordering literature, which this Article calls "breach." The Article then examines the relationship between market structure and the prevalent type of opportunism and touches briefly on

7. Degradation is a predatory act that weakens the network, harming smaller firms more than larger ones, thereby giving larger firms an advantage over smaller competitors. This concept is discussed in depth *infra* Part III.C.2.

8. For example, several networks may connect into a "network of networks," merging the networks into a single, larger network.

9. For a broader exploration of the patterns of evolution of PLSs (and in particular networks serving as PLSs), see Amitai Aviram, *The Paradox of Spontaneous Formation of Private Legal Systems*, 22 YALE L. & POL'Y REV. (forthcoming 2004) (manuscript on file with the author). An earlier, working-paper version of the article is available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=391780.

10. Such modified networks have been observed and discussed in antitrust scholarship, where they have been called "middleware," but have yet to receive significant attention from the private-ordering literature.

the relevant effects of opportunism of either type on social welfare.[11] Part IV explores the circumstances in which networks are the most efficient regulators. There is an implicit (and sometimes explicit) competition between several regulatory regimes: government regulation, network regulation (i.e., enforcement by networks), transaction regulation (i.e., enforcement by the specific parties to any given transaction), and self-regulation (i.e., self-restraint driven by morality). Building on the analysis set forth in Part III regarding types of opportunism and types of opportunism-mitigating mechanisms, this Article predicts each regulator's relative advantage in enforcing norms based, inter alia, on the prevailing market structure. The regulator with the best ability and incentive to enforce norms in given circumstances is likely to win the "competition" between potential regulators and enforce norms in that segment of human activity. Finally, Part V summarizes and concludes.

This Article offers but an initial observation of the implications of network effects on private ordering. The analysis offered in this Article provides guidelines to future detailed empirical examination of the utilization of network effects in creating institutions that enforce norms.

## II. REGULATION, PUBLIC AND PRIVATE

### *A. Opportunism*

Opportunistic default on obligations[12] is an inherent risk in any transaction between parties lacking complete control over each other's actions.[13] Such behavior harms the parties to the transaction by reducing

11. For a definition of social welfare, see *infra* Part III.C.4.

12. Opportunism may be defined as "an act in which someone destroys part of the cooperative surplus to secure a larger share of it." Robert D. Cooter, *The Theory of Market Modernization of Law*, 16 INT'L REV. L. & ECON. 141, 150 (1996). For other general definitions of opportunism, see OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING 47 (1985) (defining opportunism as "self-interest seeking with guile"); Michael P. Van Alstine, *The Costs of Legal Change*, 49 UCLA L. REV. 789, 834 (2002) (defining opportunism as "bad faith exploitation of uncertainty"). In the context of contract law, opportunism has been defined as a situation in which one party "behaves contrary to the other party's understanding of their contract, but not necessarily contrary to the agreement's explicit terms, leading to a transfer of wealth from the other party." Timothy J. Muris, *Opportunistic Behavior and the Law of Contracts*, 65 MINN. L. REV. 521, 521 (1981).

13. This statement assumes that there is no anti-opportunism regulation of the transaction (e.g., enforceable contract law). If such regulation exists, the statement would still be true where the regulating regime has weaknesses or, in the case of contract law, where the contract is incomplete.

the return on any investments they made in reliance on the defaulted obligations. Since the devaluation of the reliance investments of injured parties does not harm the defaulting party, the latter might choose to default absent some adverse sanction to such behavior, even when this results in a decrease in the combined welfare of all parties to the transaction. The devaluation of reliance investments is thus a negative externality imposed by opportunistic default on an obligation.[14] Furthermore, recognizing the risk of default, parties to a transaction may decide to invest less in reliance on the transaction than they would have if opportunistic default had been less probable or less damaging; this lower investment might result in lower utility from the transaction.

Both lowering the probability of opportunistic default on obligations and decreasing the damage caused by such default increase the welfare of potential parties to transactions. For that reason, potential parties to a transaction seek forms of regulation that would achieve either or both reduced probability and reduced damage from opportunistic default. Different entities have different advantages and disadvantages as regulators, and overlapping regulation by different entities may complement or conflict with regulation by other entities.

### *B. Classifying Regulators*

Robert Ellickson identified, in his seminal book *Order Without Law*, five categories of regulators (which he calls "controllers"): first-party controllers, second-party controllers, and three types of third-party

14. One may raise a "Coasian" argument that the negative externality of opportunism is internalized by a decrease in the price buyers would be willing to pay in a transaction that is vulnerable to opportunistic behavior. For example, if Abe knows that Ben may act opportunistically and reduce Abe's benefits from the transaction by $2, Abe will be willing to pay Ben $2 less, making him no worse and Ben no better by the opportunistic behavior. Of course, in that situation all potential opportunists would have an incentive to act opportunistically (unless they can identify themselves as nonopportunists) since they are already penalized by the buyer and so might as well recoup the penalty by benefiting from opportunistic behavior. For example, Carol, who is also a seller, might have considered not acting opportunistically towards Abe, but since Abe pays $2 less than market price (assuming the worst of the seller's behavior), Carol can only compete with Ben if she too earns back the $2 by acting opportunistically. This equilibrium, in which all potential opportunistic parties choose to act opportunistically while all injured parties reduce price and reliance, is inefficient because it precludes efficient investments that rely on the fair execution of the transaction. Regulators, by mitigating opportunism, allow either direct deterrence of opportunistic behavior or differentiation between opportunistic parties and nonopportunistic parties enabling Abe to offer a higher price to honest Carol than to opportunistic Ben, thus indirectly deterring Ben from acting opportunistically.

controllers—informal controllers (social forces), non-governmental organization controllers, and government controllers (the legal system).[15]

*1. Self-regulation*

First-party regulation, or *self-regulation*,[16] gives the role of regulator to the entity with the greatest ability to both detect and prevent norm violation—the potential norm violator herself. However, this person has the least incentive to regulate, as she is typically the primary beneficiary of the opportunistic behavior. Furthermore, this form of regulation is highly vulnerable to self-deception (i.e., the would-be norm violator may interpret norms so as not to conflict with desired, self-serving behavior). Finally, self-control is vulnerable to differences in culture or personal morality—actions that are morally repugnant to one person may be acceptable to another, and so one person's expectations of another's self-control may be frustrated even in the absence of self-deception.

*2. Transaction regulation*

In the context of norms applying to personal interactions or business transactions (as do most norms), the regulators next in proximity to the norm violator are the other parties to the transaction. Regulation by the parties to the transaction, referred to by Ellickson as "second-party controllers,"[17] may also be referred to as *transaction regulation*. Transaction regulation includes relationship-building measures, such as bilateral bonds[18] or integration,[19] and the use of third-party guarantors,[20] etc.

Second-party control presents a different set of advantages and disadvantages. The second party has an unbiased incentive to prevent

15. ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 126–32, 241–46 (1991).

16. The term self-regulation is frequently used to describe all forms of nongovernment regulation. This Article, however, differentiates between the various types of nongovernment regulation: self-regulation (facilitated by first-party controllers, in Ellickson's terms), transaction regulation (facilitated by second-party controllers), and network regulation (facilitated by informal and organizational controllers).

17. *See* ELLICKSON, *supra* note 15, at 130–32, 246–48.

18. *See, e.g.*, Rachel E. Kranton, *The Formation of Cooperative Relationships*, 12 J.L. ECON. & ORG. 214 (1996).

19. *See, e.g.*, Andy C.M. Chen & Keith N. Hylton, *Procompetitive Theories of Vertical Control*, 50 HASTINGS L.J. 573, 590–91 (1999).

20. *See* Avery Wiener Katz, *An Economic Analysis of the Guaranty Contract*, 66 U. CHI. L. REV. 47 (1999).

opportunistic default on obligations to the extent that the opportunism is at its expense,[21] and it also possesses intimate knowledge of the transaction's subject matter (e.g., the industry in which it operates). However, its ability to punish opportunism is limited since, absent coordination with or assistance from others, it can only deprive the defaulting party of their future mutual transactions.[22] If the value of such transactions is not great,[23] this sanction may fail to deter some opportunistic behavior.

*3. Government regulation*

Third-party controllers include the government and PLSs (which Ellickson further classifies into informal controllers and organization controllers).[24] Government is a natural candidate for regulating opportunism in transacting. Having a monopoly on violence and controlling specialized enforcement agencies that can enforce injunctions, fines, and damages awards, the government can impose unique sanctions such as incarceration[25] and has a greater ability to impose fines than do most other potential regulators. Unsurprisingly, therefore, government enforcement has a significant role in regulating; so great a role, in fact, that many view it as the sole, or at least the primary,

21. Some parties may enter a transaction with the intent to defraud and therefore would not have an interest in preventing opportunism at any stage. However, if a mechanism were available to prevent opportunism, the refusal of a party to implement it would signal to other parties a likely intent to defraud. Therefore, at least ex ante, parties to a transaction are likely to agree to implement mechanisms mitigating opportunism.

22. This statement assumes that the agreements between the first and second parties are enforced by the promisee. If they are enforced by government through private actions (e.g., if the promisee sues in court to enforce the agreement), then the form of regulation is a hybrid in which detection of deviation from the norm is done primarily by the second-party controller while formation of the norm and enforcement against violations are done by the government. Thus, it would not be a pure form of second-party regulation.

23. For example, the value of future transactions would not be great if the defaulting party were able to transact with other, similarly attractive firms.

24. *See* ELLICKSON, *supra* note 15, at 130–32. Both informal controllers and organization controllers are typically (but not always) networks and make use of network effects to enforce norms. Therefore, this Article does not make the distinction between these two types of network-based PLSs.

25. Despite government's ability to punish by incarceration, only the most severe norm violations are punishable by incarceration. Not all violations of norms are criminal; some give rise only to civil sanctions and others allow no legal cause of action at all. Even among criminal norm violations, very often the offender is sentenced to a fine rather than imprisonment. The criminal system deals with many forms of harmful behavior, varying in their degree of harm to society. Since sanctions are determined in proportion to the severity of the crime, the most deterring of government sanctions are not used against most common norm violations.

method of regulation. Contract law is intended to lend the power of the government's enforcement machinery to parties injured by breach of obligations. Commercial law provides more specific rules for certain common types of commercial transactions intended, among other reasons, to curb opportunistic frustration of the goals of those transactions.[26] Consumer protection law is, to a significant degree, aimed at correcting information asymmetries that make opportunistic behavior more likely.[27] Antitrust law similarly addresses opportunism that is caused by the possession or attempted acquisition of market power.[28] Industry-specific regulation often monitors and remedies opportunism by or against the firms it regulates.

Because the government, compared to other potential regulators, is usually the most distant from the norm violator, it has significant monitoring costs and costs of error. The government may attempt to reduce monitoring costs either by creating a specialized regulator or, more commonly, by allowing private rights of action (which utilize the lower monitoring costs of transaction regulation and, after verification by a court or agency, allow the use of the government's sanctions).

Both techniques suffer from significant flaws. Regulators are very expensive, are subject to capture, and have greater monitoring costs, even under optimal conditions, than the parties to the transaction. Private rights of action are subject to abuse since regardless of their merit they impose costs (legal, reputational, temporal, etc.) on the defendant and therefore may be manipulated by a plaintiff to extract a payoff from the defendant. Furthermore, the governmental verification system, usually a trial before a court, is imperfect as judges often lack the information, expertise, or time to properly verify suits.

26. *See, e.g.*, Frank B. Cross, *Law and Economic Growth*, 80 TEX. L. REV. 1737, 1749–50 (2002) ("The law also provides a benefit by providing default rules and monitoring for opportunism, which efficiently reduces the ex ante precautions that have to be taken by contracting parties.").

27. *See, e.g.*, Purity Supreme, Inc. v. Attorney Gen., 407 N.E.2d 297, 306–07 (Mass. 1980) ("The overall purpose of [the Massachusetts statute regulating business practices for consumer protection] is that of 'providing proper disclosure of information and a more equitable balance in the relationship of consumers to persons conducting business activities.'"). Removing information asymmetries and thus creating an "equitable balance" between the transacting parties requires not only the provision of information (i.e., disclosure), but also the necessary analytical tools to assess this information which depend on the sophistication of the consumer.

28. *See, e.g.*, Digital Equip. Corp. v. Uniq Digital Techs., Inc., 73 F.3d 756, 762 (7th Cir. 1996) (distinguishing Eastman Kodak Co. v. Image Technical Servs., Inc., 504 U.S. 451 (1992)).

*4. Network regulation*

Third parties other than the government are also enlisted as regulators if they have relative advantages over the parties to the transaction and the government. For example, investment banks, accountants, law firms, and other financial intermediaries often serve as "gatekeepers," since they have advantageous access to information regarding potential opportunism.[29] While gatekeepers are third parties, regulation through them may be considered more in line with Ellickson's classification of second-party control if the gatekeepers' role is limited to providing informational and other services to the second party, but the actual enforcement is done by the second party primarily through refusing to deal with the opportunistic party. In such cases, the gatekeeper is not a controller but merely a provider of a service that is used by the second party to regulate.

In contrast, other third parties, such as exchanges and trade associations, create, adjudicate, and enforce norms that are intended to reduce opportunism.[30] Typically, such third parties not only enjoy potential informational advantages, but are also able to impose sanctions against offenders that may rival or surpass the government's sanctions in their effectiveness, thus deterring opportunism and hence decreasing its likelihood. Furthermore, the same third parties are also able to replace defaulted transactions with substitute transactions more efficiently than the parties to the transaction themselves, thus mitigating the damages from default. These third parties are networks, and their efforts to enforce norms are *network regulation*.[31]

29. *See* Stephen J. Choi, *Market Lessons for Gatekeepers*, 92 NW. U. L. REV. 916 (1998); Reinier H. Kraakman, *Gatekeepers: The Anatomy of a Third-Party Enforcement Strategy*, 2 J.L. ECON. & ORG. 53, 54 (1986); Ronald J. Mann, *Verification Institutions in Financing Transactions*, 87 GEO. L.J. 2225 (1999).

30. *See, e.g.*, Lisa Bernstein, *Opting Out of the Legal System: Extralegal Contractual Relations in the Diamond Industry*, 21 J. LEGAL STUD. 115 (1992) [hereinafter Bernstein, *Opting Out*]; Lisa Bernstein, *Private Commercial Law*, *in* 3 THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 108 (Peter Newman ed., 1998) [hereinafter Bernstein, *Private Commercial Law*].

31. For a discussion of network effects, see *infra* Part III.A. Ellickson differentiates between two controllers—informal controllers and organizational controllers—both of which are usually networks. *See* ELLICKSON, *supra* note 15, at 130–32. The difference between these two types of controllers is mainly in the array of enforcement mechanisms they wield. Informal controllers make use of information and switching mechanisms, while organizational controllers make use of these two mechanisms and also of exclusion and control mechanisms. These mechanisms will be explained *infra* Part III.B. There may be some exceptions in which a specific informal or organizational controller would not be a network. But as explained *infra* Parts IV.B and IV.C, in

Networks appear in many forms: trade associations, commodity exchanges, electricity grids, internet auction sites, and peer-to-peer and business-to-business exchanges.[32] In most cases, networks do not exist solely to regulate. Rather, they exist primarily to exploit network effects and thus increase members' utility from transacting. This Article does not attempt to explain networks in general, but rather focuses on networks as regulators. In certain circumstances, networks are better regulators than the parties to the transaction or other third parties such as the government. In such cases, networks will not only facilitate transactions, but also act as regulators. Anti-opportunism mechanisms instituted by the network may displace counterpart measures applied by other regulators (e.g., government regulation, bilateral contracting, etc.). Identifying these circumstances and the mechanisms used by networks to combat opportunism is a goal of this Article.

*5. Interaction between multiple regulators*

Regulation by one regulator does not necessarily exclude other regulators. Very often each regulator regulates those aspects in which it is most efficient, relying upon another for regulation of other aspects. The prospect of being regulated by a default, less efficient regulator may even serve as an incentive to adhere to the more efficient regulator. For example, transaction regulation very often operates "in the shadow of the law," efficiently mitigating opportunism in transactions with lower value while relying on the ability to sue in court to mitigate opportunism in higher-value transactions in which the costs and delays of the government regulation do not dissipate most of the value of the dispute.[33]

However, to a certain extent, each regulator's activity may weaken another regulator's ability to regulate. Self-regulation (i.e., morality and

many circumstances networks tend to have an advantage in regulating over nonnetwork third-party controllers, and therefore nonnetwork third-party controllers tend to be uncommon.

32. Examples of business environments significantly influenced by networks include exchanges (securities exchanges, commodity exchanges, etc.); financial networks (credit card networks, ATM networks, check clearance, etc.); communications (long distance and international telephony, cellular telephony, internet backbone services, etc.); transportation (air, sea, and land transportation); mail and express services (domestic and international); and energy networks (electricity, gas and oil pipelines).

33. *See, e.g.*, Robert H. Mnookin & Lewis Kornhauser, *Bargaining in the Shadow of the Law: The Case of Divorce*, 88 YALE L.J. 950, 968 (1979) (noting that private resolution of disputes receives a powerful incentive from "the outcome that the law will impose if no agreement is needed").

self-control) may be more lax in a strict environment that is rife with rules enforced by other regulators. For example, one may obey the externally enforced rules but not exercise significant self-restraint in matters not prohibited by the rules.[34] Network regulation is often biased by the existence of government regulation because regulated parties' activities may be aimed at either appeasing the government regulator or "capturing" it, either of which may diverge from the course of action needed to efficiently mitigate opportunism. Where government regulation is more efficient but the government lacks the means to enforce its regulation, as is the case in some developing countries and occasionally in certain areas of developed countries, network regulation that substitutes for government law enforcement becomes redundant when the government increases enforcement.[35] Likewise, network regulation can reduce the effectiveness of transaction regulation by decreasing the quality of partners to bilateral contracting who remain outside the network.[36] The converse is also true—transaction regulation may reduce the effectiveness of network regulation by diverting transactions away from the network, thereby decreasing the effectiveness of the network's enforcement mechanisms.[37]

### *C. Elements that Facilitate Private Ordering*

The literature on private ordering examines regulation by parties other than government: rules, norms, and institutions that are self-imposed by private parties (or evolve)[38] to govern their behavior and

34. On the weakening of corporate morality as a result of increased rule-based regulation, see Lawrence E. Mitchell, *Cooperation and Constraint in the Modern Corporation: An Inquiry into the Causes of Corporate Immorality*, 73 TEX. L. REV. 477 (1995).

35. *See* John McMillan & Christopher Woodruff, *Private Order Under Dysfunctional Public Order*, 98 MICH. L. REV. 2421, 2445 (2000) ("Private order can serve as either a complement to or a substitute for public order . . . . An improvement in the law will increase the use of complementary private-order mechanisms; it will similarly decrease the use of substituting private-order mechanisms."); Curtis J. Milhaupt & Mark D. West, *The Dark Side of Private Ordering: An Institutional and Empirical Analysis of Organized Crime*, 67 U. CHI. L. REV. 41, 91–97 (2000) (discussing the effectiveness of public enforcement of property rights, rather than public enforcement of criminal law, in reducing organized crime, which is a PLS).

36. *See* Raja Kali, *Endogenous Business Networks*, 15 J.L. ECON. & ORG. 615, 629 (1999).

37. This Article will explain what the network's specific enforcement mechanisms are *infra* Part III.B. Transaction regulation reduces the effectiveness of the exclusion and switching mechanisms due to a decrease in network benefits, and of the control and information mechanisms due to lack of network control over the bilateral transactions.

38. Some norms are not contemplated and imposed, but evolve. *See* Posner, *supra* note 4, at 1699 ("The rule-like nature of a norm should not disguise the fact that norms are not enacted and

transactions.[39] Macaulay's seminal work in this field observed that few contractual disputes are litigated and most are settled without resorting to government-enforced laws.[40] Subsequent research pointed out two advantages in mitigating opportunism that certain nongovernment institutions may possess. In analyzing the institutions that mitigate opportunism, the private-ordering literature emphasizes two elements: repeated play and reputation.

*1. Repeated play*

The repeated-play element addresses the perception of the parties to a transaction that they are likely to transact again in the future. As a result of this perception, each party's behavior in the current transaction may have consequences in future transactions.[41] For example, if John promises to buy Dan's car but then reneges on that promise, Dan may refuse to transact with John in the future or may deal with John in the future under terms less favorable to John, both as a punishment and because Dan now takes into account the greater likelihood of John's defaulting again. Knowing these are the likely consequences, John will be hesitant to renege on his promise in the first place, at least if he anticipates that the cost of losing future transactions with Dan will be greater than the benefit from reneging on the current promise.

enforced like statutes. It is more plausible to say that when people observe some behavior, they more or less spontaneously approve or disapprove of it (or fail to react), and then reward, penalize, or ignore the actor.").

39. *See, e.g.*, Stuart Banner, *The Origin of the New York Stock Exchange, 1791–1860*, 27 J. LEGAL STUD. 113 (1998); Lisa Bernstein, *Private Commercial Law in the Cotton Industry: Creating Cooperation Through Rules, Norms, and Institutions*, 99 MICH. L. REV. 1724 (2001); Robert C. Ellickson, *A Hypothesis of Wealth-Maximizing Norms: Evidence from the Whaling Industry*, 5 J.L. ECON. & ORG. 83 (1989); Milhaupt & West, *supra* note 35.

40. Stewart Macaulay, *Non-Contractual Relations in Business: A Preliminary Study*, 28 AM. SOC. REV. 55, 61 (1963).

41. *See* David M. Kreps, *Corporate Culture and Economic Theory*, *in* PERSPECTIVES ON POSITIVE POLITICAL ECONOMY 100–06 (James E. Alt & Kenneth A. Shepsle eds., 1990); Marleen A. O'Connor, *The Human Capital Era: Reconceptualizing Corporate Law to Facilitate Labor-Management Cooperation*, 78 CORNELL L. REV. 899, 927 (1993) ("Economists suggest, however, that repeated play of a noncooperative game usually produces results similar to those achieved under a cooperative game in which such commitments are possible. Specifically, repetition allows the implicit agreement to refrain from opportunism to become self-enforcing because each player recognizes that the decision to defect in any round of play will trigger a similar response from the other player in the next round. The combination of the fear of retaliation for defecting and the prospect of future benefits from cooperating may cause the players to reach a mutually beneficial solution. Once the players make the initial move to cooperate, a 'lock-in' effect arises that promotes a pattern of collaboration through the game.").

*2. Reputation*

Reputation expands the scope of future consequences, by enabling other firms that were not parties to a given transaction to learn of the trustworthiness of the parties to that transaction and to act on that knowledge.[42] Returning to the above example, John might realize that not only will reneging on his promise to Dan cause Dan to transact with him less favorably in the future, but John may also expect similar treatment from anyone who learns of his default. This reaction has nothing to do with sympathy for Dan—it is in the best interest of each person to be averse to dealing with another person who is likely to default on promises. A credible account of past behavior (i.e., reputation) is usually perceived as a good proxy for assessing the likelihood of future default on obligations. A party's reputation therefore interests third parties and affects their disposition towards the person whose reputation they are aware of.

*3. Network effects*

This Article discusses a third element that affects the analysis of opportunism-mitigating institutions—network effects. Private-ordering scholarship has examined business environments that are dominated by networks, such as merchant coalitions[43] and commodity and financial exchanges.[44] It has also noted the use of social networks to combat opportunism in business transactions.[45] However, it rarely distinguishes between institutions that are networks (that is, institutions characterized by network effects) and those that are not.[46] As a result, the literature

42. *See, e.g.*, David Charny, *Nonlegal Sanctions in Commercial Relationships*, 104 HARV. L. REV. 373, 409–20 (1990); Kreps, *supra* note 41, at 106–08.

43. *See* Karen Clay, *Trade Without Law: Private-Order Institutions in Mexican California*, 13 J.L. ECON. & ORG. 202 (1997); Avner Greif, *Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition*, 83 AM. ECON. REV. 525 (1993).

44. *See, e.g.*, Banner, *supra* note 39; Bernstein, *supra* note 39; Stephen Craig Pirrong, *The Efficient Scope of Private Transactions-Cost-Reducing Institutions: The Successes and Failures of Commodity Exchanges*, 24 J. LEGAL STUD. 229 (1995); Mark D. West, *Private Ordering at the World's First Futures Exchange*, 98 MICH. L. REV. 2574 (2000).

45. *See, e.g.*, Janet T. Landa, *A Theory of the Ethnically Homogeneous Middleman Group: An Institutional Alternative to Contract Law*, 10 J. LEG. STUD. 349 (1981). *See also* Bernstein, *Private Commercial Law*, *supra* note 30, at 110; Bernstein, *Opting Out*, *supra* note 30, at 130; Kali, *supra* note 36.

46. Some of the literature does make relevant distinctions. For example, McMillan and Woodruff distinguish between "bilateral relational contracting" and "multilateral relational contracting." *See* McMillan & Woodruff, *supra* note 35, at 2430–35. Not all multilateral contracts

usually discusses only types of opportunism that are common to both network and nonnetwork business environments[47] and primarily examines regulation mechanisms that are common to both of these environments.[48]

Below, this Article examines how transacting in a network environment involves both unique risks of opportunism and unique, or at least in many circumstances significantly superior, abilities to regulate against opportunism. The next section begins this analysis by examining the relevant characteristics of networks.

## III. REGULATING IN A NETWORK ENVIRONMENT

### *A. Network Effects*

#### *1. What are network effects?*

While networks may enjoy economies of scale and scope in *production*, the unique quality of a network is economies of scale and scope in *demand*. Economists refer to this phenomenon as "network effects": the value of membership in a network is enhanced by an increase in the number of other members or in the other members' usage of the network.[49] An example is an internet marketplace, such as eBay. If I want to sell an item, the probability that I will find a potential buyer increases as more people use the same internet marketplace. And as a

are necessarily associated with networks. However, most of the multilateral contracts examined in the literature relate to networks, probably due to the advantages that a network possesses (over other multilateral institutions) in regulating.

47. Typically, the private-ordering literature examines opportunism of the type this Article defines as "breach" *infra* Part III.C.1. Transacting in network environments may also risk a markedly different type of opportunism which this Article defines as "degradation" *infra* Part III.C.2.

48. For example, as mentioned above, the literature emphasizes the role of reputation in restraining opportunism. Networks may be able to exploit economies of scale and solve collective action problems in monitoring reputation (*see* discussion on the information mechanism *infra* Part III.B.1), but they also have other opportunism-reducing mechanisms in their arsenal, including the ability to coordinate among the network members so that the opportunistic party faces a collective sanction from all members. Some scholars have addressed the need for coordination. *See, e.g.*, McMillan & Woodruff, *supra* note 35, at 2439 ("Providing information about those who cheat may not suffice to deter cheating when punishment is costly—coordination may be required . . . ."). However, they have not focused on the connection between network effects and the effectiveness of coordinating mechanisms.

49. *See* Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. POL. ECON. 822, 824 (1986).

buyer, the probability that I will find a person wishing to sell the very item I seek likewise increases as more people use the marketplace.

In industries characterized by economies of scale in supply, firms lower their production costs by drawing more demand for their product, allowing them to produce more of the product and thus benefit from the economies of scale. But in network industries, firms can lower their costs,[50] without having to wrest customers from their competitors, by interconnecting with competitors (i.e., making their product or service compatible with the competitors'), thus allowing each firm's customers to reap demand-side economies of scale as if the customers of that firm's competitors were its own.[51] As Richard Posner notes, "[E]conomies of consumption presuppose uniformity rather than a common source."[52]

For example, the benefits to customers of a cellular telephone company increase as customers are able to talk to more people with their phones. A cellular telephone carrier could, by interconnecting with another carrier, offer its customers the added benefits of talking with the other carrier's customers, making each carrier's service as attractive as if one of the carriers acquired all of the other's customers. This characteristic of network industries creates a significant incentive for

50. Alternatively, firms can increase the consumer's benefit from its products without increasing costs, which is equivalent to lowering costs.

51. Compare the following two situations. First, Acme Corp. and Ajax Corp. are rival steel producers. Steel is produced most cheaply when the output is at least 60 tons. This is a normal, supply-side economy of scale. The total demand for steel from all customers is 100 tons. Both Acme and Ajax vie to get orders for 60 tons of steel, but only one of them can reach that goal since if one has orders for 60 tons, other customers demand only 40 additional tons. If Acme succeeds in receiving orders for 60 tons of steel, its production costs will be lower than Ajax's, and (assuming production costs don't rise again for production above 60 tons) it would then be able to undercut Ajax's prices and receive orders for the remaining 40 tons, driving Ajax out of business. Since both Acme and Ajax know that the competition for the first 60 tons determines which of them will survive, both would expend significant resources in defeating the other.

Contrast that situation with the second situation: Acme and Ajax are rival telephone companies, and their networks are connected so that an Acme customer can call an Ajax customer and vice versa. Telephone service provides peak utility to the customers when it connects at least 60 people. This is a network effect—a demand-side economy of scale. There are only 100 people in the territory Acme and Ajax operate in. If each has at least 30 customers, then each firm's telephone network is connected to 60 people and provides peak utility. While each company might want to expand its business by taking its rival's customers, it is not a survival contest. If the connection between customers of the two firms is of the same quality as the connection between customers of the same firm, then both firms would offer the same utility to their users regardless of differences in the number of customers each firm has.

52. POSNER, *supra* note 6, at 248.

creating interfirm networks.[53] It also makes membership in a large network (i.e., the ability to transact through the network) a valuable asset.[54] The network's ability to exclude a member may therefore be a powerful sanction.[55]

Economists categorize network effects into two types: direct and indirect. Direct network effects are "generated through a direct physical effect of the number of purchasers on the value of a product."[56] For example, a telephone network derives its network effects directly from the ability of each user to communicate with each of the other users.[57] Indirect network effects, in contrast, are observed when the value of a product increases as a result of an increase in the purchase or use of a complementary product. For example, if more people use Excel, there will be more people any given user can obtain help from and more books and courses on how to use Excel; if more people carry MasterCards, more merchants will take MasterCards, making the cards more valuable to both cardholders and merchants.[58]

The concept of network effects is not at all a novel one. Perhaps the most ancient example of recognition of the enhanced benefits that result from connectivity between entities is found in the book of Genesis: "Here they are, one people with a single language, and now they have started to do this [building the Tower of Babel]; henceforward nothing

53. For example, banks created clearinghouses to facilitate the exchange and redemption of bank notes and later checks. *See* Alan S. Frankel, *Monopoly and Competition in the Supply and Exchange of Money*, 66 ANTITRUST L.J. 313, 325 (1998). Later, banks created networks facilitating ATM and credit card transactions. *Id*. at 338–41.

54. This does not mean that network effects inevitably result in natural monopolies. Differences in the quality of competing network goods or in their production costs may offset the relative advantage of the larger network. Furthermore, at a certain point, production costs often exhibit decreasing returns to scale (i.e., they rise as production increases). This increase in cost may offset the increasing returns to scale derived from the network effect. *See* S.J. Liebowitz & Stephen E. Margolis, *Network Effects and Externalities*, *in* 2 THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 671, 672 (Peter Newman ed., 1998).

55. *See, e.g.*, Bernstein, *supra* note 39, at 1767–68 ("Although most transactors are willing to deal with nonmembers (albeit somewhat reluctantly and on slightly different terms) as long as they have good reputations, they are extremely reluctant to deal with someone who has been expelled from an association. As one mill explained, for a merchant, 'be[ing] expelled [from a shippers' association] is usually a death blow to [his] business.'" (alterations in original)).

56. *See* Liebowitz & Margolis, *supra* note 54, at 671.

57. *See* Jeffrey Rohlfs, *A Theory of Interdependent Demand for a Communications Service*, 5 BELL J. ECON. & MGMT. SCI. 16 (1974) (noting network effects in communications services industries and examining the influence of network effects on pricing and barriers to entry into the industry).

58. *See* David S. Evans & Richard Schmalensee, *A Guide to the Antitrust Economics of Networks*, 10 ANTITRUST 36 (1996).

they have a mind to do will be beyond their reach."[59] Language is characterized by network effects—the benefit derived from communicating in a language increases significantly as more people are familiar with it.[60] Increased "membership" in this network (i.e., fluency in the language) allows communication and coordination among a larger number of people, which confers greater benefits to each of them. Babel was destroyed by undoing its linguistic network:

> 'Come, let us go down there and confuse their speech, so that they will not understand what they say to one another.' So the Lord dispersed them from there all over the earth, and they left off building the city. That is why it is called Babel, because the Lord there made a babble of the language of all the world.[61]

In the rest of this section, this Article will discuss two aspects of network effects that are important in their implications on networks' effectiveness as regulators. First, this Article will examine compatibility, which produces network effects, but the manipulation of which may be a powerful form of opportunistic behavior. Second, this Article will discuss the literature analyzing the impact of network effects on forms of organization. This Article adds to that line of literature by showing how a network form of organization enforces norms and when it is effective in doing so.

*2. Compatibility, incompatibility, and harm from compatibility*

Network effects are derived from compatibility, which allows several people to use the same network. Compatibility may be achieved by joint decision (e.g., coordinated acceptance of a standard) or unilaterally by a single firm constructing an "adapter" that makes its product compatible with another.[62] Private incentives for compatibility may differ from public incentives, possibly resulting in private action that fails to maximize social welfare from the network effects. One strand of the literature on network effects examines the choice between unilateral and

59. *Genesis* 11:6 (New English Version).

60. For a more contemporary analysis of network effects of language, see Jeffrey Church & Ian King, *Bilingualism and Network Externalities*, 26 CAN. J. ECON. 337 (1993).

61. *Genesis* 11:7–8 (New English Version).

62. Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424, 434–39 (1985).

coordinated facilitation of compatibility.[63] This issue is of considerable importance to antitrust scholarship, as coordinated facilitation of compatibility is usually more suspect of being used for anticompetitive ends than its unilateral counterpart, and it is therefore important to understand whether it has a redeeming advantage in increasing social welfare through exploitation of network effects.[64]

Partial compatibility (i.e., compatibility among some but not all firms or individuals) results in competition between several networks.[65] Scholars dispute whether this competition leads, as may be expected of a competitive process, to the adoption of the most efficient network (e.g., the network providing the most efficient service or promulgating the most efficient standard or norm). Katz and Shapiro demonstrate that the presence of network effects leads to multiple equilibria in a competition between networks, and consumer expectation is key in determining which equilibrium emerges.[66] Generally, as the argument goes, consumers will prefer to join a network that they perceive as likely to become or is already the market leader. This preference may trump consumers' preferences regarding the product or service itself, so that an inferior product that is perceived to be the market leader, perhaps because it was a first-mover into the market, will be preferred over superior but smaller competitors.[67]

63. *See, e.g.*, Joseph Farrell & Garth Saloner, *Converters, Compatibility, and the Control of Interfaces*, 40 J. INDUS. ECON. 9, 32 (1992) [hereinafter Farrell & Saloner, *Control of Interfaces*] (finding that when adapters do not facilitate perfect compatibility, their introduction might reduce social welfare below that in an industry without adapters at all); Joseph Farrell & Garth Saloner, *Coordination Through Committees and Markets*, 19 RAND J. ECON. 235 (1988) (comparing committee agreement on standards, unilateral declarations of standards by single firms followed by independent decisions by other firms concerning which standard to follow, and a hybrid system adapting features of both the committee and the market leadership mechanisms).

64. *See* Eliason Corp. v. Nat'l Sanitation Found., 614 F.2d 126, 129 (6th Cir. 1980) (stating that alleged boycotts arising from industry self-regulation do not give rise to a Sherman Act violation absent discrimination or manifestly anticompetitive and unreasonable conduct); FEDERAL TRADE COMMISSION & UNITED STATES DEPARTMENT OF JUSTICE, ANTITRUST GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS (2000). *But see* Fashion Originators' Guild of Am. v. FTC, 312 U.S. 457, 461, 468 (1941) (condemning coordinated activity aimed at preventing and punishing "style piracy" and stating that "even if copying were an acknowledged tort under the law of every state, that situation would not justify petitioners in combining together to regulate and restrain interstate commerce").

65. Members of each network enjoy compatibility among themselves but not with members of other networks. If members of one network were compatible with members of another network, the two networks would have been, in effect, a single network, and thus would not compete with each other.

66. *See* Katz & Shapiro, *supra* note 62.

67. *Id*. at 439. *See also* Katz & Shapiro, *supra* note 49, at 825.

This argument led to a line of literature examining network effects as barriers to entry and as the cause of the alleged persistence or "lock-in" of less efficient network goods.[68] If network "lock-in" theory, which has been disputed by some scholars, is correct, then an inefficient norm may nonetheless prevail because the network enforcing it is larger and therefore confers greater network effects than rival networks enforcing other more efficient but less popular norms. However, even if the "lock-in" theory is correct, it may have less force regarding the perseverance of inefficient norms than that of a technical standard because there are several potential regulators other than networks that could adopt a more efficient norm if the regulating network declines to adopt it. The bigger the relative advantage of a network in enforcing the norm,[69] the more resistant it would be to the threat of competing regulators (and thus the more able it is to persist with an inefficient norm). The less efficient the network's norm is compared to the alternative norm, the lower the network's resistance to the threat of competing regulation. Network "lock in," if it is significant, may also affect the resilience of networks in adapting themselves to increase their ability and incentive to regulate efficiently.[70]

Increased compatibility does not always increase social welfare. First of all, network effects (i.e., demand-side increasing return to scale) are

68. Katz and Shapiro demonstrated that the presence of network effects may lead to excessive standardization. Katz & Shapiro, *supra* note 49. Farrell and Saloner created a model suggesting that new technology may not be adopted even if it is superior to existing technology, because of "excess inertia" caused by the presence of an installed base. Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation*, 76 AM. ECON. REV. 940, 954 (1986). Among the anecdotal empirical evidence they cite in support of their theory is the persistence of the allegedly inefficient "QWERTY" keyboard, an anecdote that was used in another article to demonstrate that industries may lock in to inefficient standards. Paul A. David, *Clio and the Economics of QWERTY*, 75 AM. ECON. REV. 332 (1985). Other scholars rejected the likelihood of an inefficient lock-in. Liebowitz and Margolis refuted the lock-in hypothesis in the QWERTY anecdote as well as in another much-cited anecdote—the VHS/Beta competition over the video cassette standard. *See* S.J. Liebowitz & Stephen E. Margolis, *The Fable of the Keys*, 33 J.L. & ECON. 1 (1990); S.J. Liebowitz & Stephen E. Margolis, *Path Dependency, Lock-in, and History*, 11 J.L. ECON. & ORG. 205, 208–09 (1995). On these two anecdotes and a few others, see also Michael I. Krauss, *Regulation v. Markets in the Development of Standards*, 3 S. CAL. INTERDISC. L.J. 781, 800–08 (1994); S.J. Liebowitz & Stephen E. Margolis, *Should Technology Choice be a Concern to Antitrust Policy?*, 9 HARV. J.L. & TECH. 283, 314–16 (1996). This issue is still hotly debated among scholars. *See, e.g.*, William E. Cohen, *Competition and Foreclosure in the Context of Installed Base and Compatibility Effects*, 64 ANTITRUST L.J. 535, 539–46 (1996).

69. A discussion of the circumstances that affect networks' ability to enforce norms will follow *infra* Part IV.B.

70. This Article will discuss networks' ability to change in a manner that increases their incentive to regulate efficiently *infra* Part IV.B.3.

usually reduced and might even reverse above a certain point. At a point, they may become "network defects"—a net disutility from an increase in the number or volume of users of the network good. Reasons for this reversal may include congestion on the network or relative advantages of one system over another that have to be sacrificed to ensure compatibility.[71]

Second, the connectivity that enables the flow of positive externalities also enables the flow of negative externalities. For example, a computer virus that exploits a loophole in Microsoft Outlook is much more dangerous when most people use that program (and therefore become infected and subsequently infect others). Similarly, while interaction between people is the source of network benefits in a social network, it is also the channel by which communicable diseases spread; tighter social connectivity results in faster and more harmful communication of diseases. Indeed the recent SARS epidemic demonstrated the importance of quarantining (a social network's form of reduction in network connectivity).

Therefore, there may be a maximum efficient size for a network and a refusal to allow compatibility with other systems may be designed to prevent a network from expanding beyond its efficient size. Furthermore,

71. Congestion is a major limit on efficient scales in rivalrous networks, i.e., networks in which, besides the positive network externality, there is a negative externality imposed by an additional member of the network on the other members. Rivalrous networks include, inter alia, cellular phones, broadband internet, and peer-to-peer information networks. Nonrivalrous networks, such as languages, PC or video cassette standards, etc., do not suffer from congestion; it is no more difficult for me to express myself in English merely because many millions of additional people also express themselves in English. However, other traits might impose a limit on the efficient size of the network. For example, certain languages may express some matters in greater precision than others and compatibility, meaning integrating one language into another or creating a one-to-one translation for each word, will result in losing those nuances. Eskimos are said to have hundreds of words describing types of ice. *See* Jennifer L. Tomsen, *"Traditional" Resource Uses and Activities: Articulating Values and Examining Conflicts in Alaska*, 19 ALASKA L. REV. 167, 196 (2002) ("Yupik Eskimos living in central Alaska developed an immense variety of words to describe the snow and ice around them."). To allow complete compatibility with other languages, all these nuanced differences must be sacrificed and the various words translated into the general word "ice." The same is true for standards. For example, the JPEG computer graphic file standard is better than the competing GIF standard for multi-color images, but poorer when the image contains large areas with the same color. *See* John Wurtzel, *GIF vs. JPEG*, (Jul. 31, 1997), *at* http://hotwired.lycos.com/webmonkey/geektalk/97/30/index3a.html?tw=design. The choice between standards or languages will depend on which nuances or special advantages are more commonly used by each prospective member of the network. Those with a strong preference for a nuance or specific advantage will prefer to maintain this advantage even at the price of foregoing additional network benefits (e.g., people who care for minute differentiation when referring to types of ice might prefer to speak a more obscure, but also more exacting, language).

facilitating compatibility has various costs.[72] For this reason, a refusal to be compatible may at times increase social welfare.

However, firms may have incentives to refuse to be compatible even when compatibility would increase social welfare. Farrell and Saloner observe that in deciding whether to make two technologies compatible where one technology is supplied by a single firm, that firm may have an incentive to make conversion costly.[73] Cremer, Rey, and Tirole expand on this insight, terming this increase in the cost of compatibility (or a reduction in its quality) "degradation."[74] They refer to compatibility as "connectivity" and examine the plausibility of such a strategy and its effect on social welfare. This Article examines, among other issues, "degradation" as a form of opportunistic behavior.

*3. Network effects and forms of organization*

While the social welfare implications of network effects have been and continue to be examined thoroughly, less attention has been given to the implications of network effects on the form of organization. Even less attention has been given within this latter issue to the implications of network effects on institutions that mitigate opportunism (i.e., how network effects are used to fight "garden-variety" opportunism and how institutions combat opportunism that is unique to network environments).

Much of the research following Macaulay's observation on opting out of the (public) legal system examines bilateral, relationship-based transacting, in which reputational investments in the relationship serve as collateral against opportunism. Geertz notes that buyers and sellers in bazaars tend to pair off in recurrent transactions.[75] Posner points out a similar pattern of "barter friendships" within primitive societies, which require the parties to observe standards of loyalty similar to those they

72. These costs include actual costs of coordination, loss of freedom to vary due to the need to remain compatible, forced disclosure of proprietary information, facilitating anticompetitive coordination, etc.

73. Farrell & Saloner, *Control of Interfaces*, *supra* note 63, at 26–28.

74. Jacques Cremer, Patrick Rey & Jean Tirole, *Connectivity in the Commercial Internet*, 48 J. INDUS. ECON. 433, 435 (2000).

75. Clifford Geertz, *The Bazaar Economy: Information and Search in Peasant Marketing*, 68 AM. ECON. REV. 28, 30–31 (1978). For similar observations, see also CYRIL BELSHAW, TRADITIONAL EXCHANGES AND MODERN MARKETS 78–81 (1965) (noting that traders in traditional markets tend to personalize their exchange relations to mitigate contractual uncertainty or opportunism).

owe their kinsmen.[76] Such a status and its attached obligations serve to mitigate opportunism despite the absence of public enforcement.[77] Landa expands Geertz's and Posner's observations by considering a wider network relationship, which she identifies as "an ethnically homogeneous middleman group."[78] This group facilitates exchanges where government enforcement of law is deficient—and the certainty of abiding by contracts is consequently lacking—by taking advantage of the high barriers to entry into an ethnic social group. These high barriers create a need to stay on good terms with one's existing ethnic group.[79] Landa follows the method of analysis used earlier by Akerlof to explain the caste system in India:[80] an ethnic group can impose an efficient code of behavior through the threat of exclusion, and it can provide low-cost, accurate information on the trustworthiness of its members by economizing on information collection. Landa's focus, therefore, is on networks' mitigation of informational asymmetries.

A few scholars have examined the effects networks have in coordinating punishment against opportunists. Greif modeled a "Multilateral Punishment Strategy" patterned after the Maghribi merchant coalitions.[81] His model considers what is effectively a decentralized network in which the decisions (mainly, whether to punish or exclude opportunists) are made by each member separately, and the network facilitates the exchange of information that identifies a member as an opportunist.[82] Clay modified this model patterned after merchant coalitions in early nineteenth-century Mexican California to incorporate

76. Richard A. Posner, *A Theory of Primitive Society, with Special Reference to Law*, 23 J.L. & ECON. 1, 26 (1980).

77. *Id*.

78. Landa, *supra* note 45, at 350.

79. It is worthwhile to note that the barriers to entry into an ethnic social group are generally not directly related to network effects. The difficulty of joining such a group does not tend to have a relationship to the size of the group but rather to its customs of recognizing kinship. Ethnic groups rarely accept as kin people who are unrelated by blood or marriage, though, as Posner notes in his article, *supra* note 76, at 26, this occasionally occurs. Since it is difficult to join a new ethnic group, severing ties with one's original ethnic group is harmful, especially in a society in which most people do not deal with others who are not of their ethnic group.

80. *See* George Akerlof, *The Economics of Caste and of the Rat Race and Other Woeful Tales*, 90 Q.J. ECON. 599, 608–11 (1976).

81. Greif, *supra* note 43, at 531–42.

82. Because the network-facilitated exchange of information on trustworthiness still leaves decisions on how to react to this information to the individual merchants, this is an example of the information mechanism which will be discussed *infra* Part III.B.1. If the network also coordinated actions on the information (e.g., by having a committee make a decision binding on all members as to who could be boycotted due to dishonesty), it would be an example of the exclusion mechanism.

different strategies of specific merchants regarding dealing with people who other members of the network tagged as "dishonest."[83] McMillan and Woodruff point to the role of private-order organizations in coordinating responses to opportunism.[84]

This Article classifies the mechanisms that networks use to mitigate opportunism from a perspective of manipulation of network effects. Two of these mechanisms, the information mechanism and the exclusion mechanism, are refinements of elements the private-ordering literature has observed—reputation and boycott/refusal to deal, respectively. The Article also identifies two other mechanisms that are used by networks to enforce norms—the control mechanism and the switching mechanism.

### *B. Mechanisms for Regulation by Networks*

Network effects are the source of several comparative advantages that networks possess in regulating compared to regulation by other institutions. The mechanisms used by networks to enforce norms are also used by nonnetwork regulators (e.g., in transaction regulation). However, network effects make each of these mechanisms more effective. Therefore, in situations where these mechanisms are effective in enforcing norms, networks are likely to be a more effective regulator than other potential regulators.

#### *1. Information mechanism*

The first of four norm-enforcement mechanisms employed by networks is the information mechanism—collecting and disseminating among members and nonmembers information mainly regarding the credibility of firms that are members of the network. The information mechanism facilitates independent decisions by firms, such as whether to deal with a firm that the network reports as having acted opportunistically. This mechanism complements the exclusion and control mechanisms by expanding the scope of sanctions beyond members of the network to nonmembers.[85]

The information mechanism is not unique to networks. Independent firms invest in collecting information on potential business partners and

83. Clay, *supra* note 43.

84. McMillan & Woodruff, *supra* note 35. This role comes in addition to the role of collecting information to detect opportunism.

85. The information mechanism also expands the scope of enforcement among the network members to sanctions that are not imposed collectively by the network.

may monitor their behavior. However, there are significant economies of scale to monitoring transactions and collecting and verifying information on trustworthiness,[86] and private parties may have too small a transaction volume at stake to justify extensive collection of information. Private information collection firms, such as credit rating agencies, can exploit these economies of scale just as well as networks by specializing in monitoring and collecting information and selling the information to many interested parties. Yet networks may have an advantage over information collection firms regarding information on their members, particularly when their control mechanism is effective. When members transact mostly over the network's transacting facilities, an ancillary byproduct is that the network can monitor the transactions quickly and accurately at a low cost. Even when a centralized transacting facility is absent, networks may acquire information on members more cheaply than outsiders. (For example, social networks usually lack a centralized transacting facility, yet gossip on members is transmitted frequently.)

Networks not only have a cost advantage over other parties in collecting and verifying information on members, but also greater credibility in conveying this information to nonmembers. If a network successfully induces nonmembers to join the network's own decision to exclude a member, it increases the magnitude of the sanction (and thus the ability to enforce norms) by increasing the scope of people sanctioning the excluded member.

*2. Exclusion mechanism*

A second mechanism that networks use to enforce norms is the exclusion mechanism—denying the offending network member access to the network, either permanently (expulsion) or temporarily (suspension). Since network effects, when significant, grant considerable utility and markedly decrease the cost of transacting, revoking a member's access to the network can be a serious sanction. Therefore, the network wields a significant threat over its members in the form of exclusion from the network.[87] Exclusion is possible, of course, not only in network

86. *See, e.g.*, Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 600 (1984).

87. The use of suspension as a penalty, instead of exclusion, is sometimes preferred in order to avoid an "endgame" situation in which the expelled party has nothing to lose once it acts opportunistically in a certain instance. *See* Bernstein, *Opting Out*, *supra* note 30, at 129.

transactions but in bilateral transactions as well (e.g., Jane may refuse to transact with John).

However, the exclusion mechanism is more effective when employed by networks than by individual parties to the transaction because a network coordinates the exclusion decision among all its members. As mentioned above,[88] coordination of anti-opportunism measures enhances the effectiveness of these measures. A network is in an excellent position to coordinate members' sanctions and, through exclusion, to deny the offending party the network benefits conferred by the other members. In some industries, most business is conducted through the network, and therefore exclusion from the network precludes a firm from most potential transactions. In many industries, exclusion from certain networks results in nonmembers' refusal to deal with the excluded firm.[89] Hence, exclusion from a network may result in exclusion from the entire line of business; this is a very powerful sanction, rivaling the government's in effectiveness.[90] However, exclusion may be ineffective when the severing of ties harms the network more than the individual member; This Article will address such situations below in the discussion of degradation.[91]

Besides denying the opportunistic member the network's benefits, exclusion also reduces the value of or eliminates the network-specific investments that the member has made. The nature and value of these

88. *See supra* Part III.A.3 (citing McMillan & Woodruff, *supra* note 35).

89. Nonmembers' refusals to deal may be independent, due to viewing the expulsion as a signal regarding the trustworthiness of the expelled member. Alternatively, nonmembers might have undertaken an obligation to refuse to deal with persons expelled or otherwise sanctioned by the network. Such obligations de facto expand the size of the network that is being regulated. An example of such an obligation is a bylaw of the World Federation of Diamond Bourses, requiring all members to enforce arbitration judgments of other members. *See* Bernstein, *Opting Out*, *supra* note 30, at 121.

90. As Bernstein has noted,

> In most industries . . . it is rarely necessary for a party to seek judicial enforcement of an [arbitration] award. Merchant tribunals are able to place their own pressures on the parties to comply promptly with their decisions. In the diamond industry, for example, when a party does not comply with an arbitration award, every diamond bourse in the world posts his picture along with a statement detailing his noncompliance. He may also be suspended or expelled from the bourse that rendered the judgment and banned from entering all bourses in the World Federation of Diamond Bourses. Being subject to these types of sanctions makes it unlikely that a trader will be able to remain in the diamond business.

Bernstein, *Private Commercial Law*, *supra* note 30, at 109.

91. *See infra* Part III.C.2.

investments varies from network to network. Investments may include physical elements required to connect with the network (which may be unsalvageable and useless if connection to the network is denied), network-wide reputation, etc. Viewed from this perspective, the assets over which a member surrenders control to the network are a form of bond[92] or "hostage."[93] An example is the charge of admission fees by trade associations and their control over information they provide to their members. Trade associations may confiscate these fees and other assets over which the network has control as sanctions against a member's opportunistic behavior.[94]

*3. Control mechanism*

The control mechanism makes use of centralized control[95] over facilities required for transacting. Such centralized facilities include electricity grids run by independent system operators, or the eBay servers that process all transactions that are made through the online auction site. In social networks, these facilities might be reputation or accrued goodwill. In transportation networks, these might be terminals and jointly-used tracks or roads. In exchanges, they are clearinghouses and funds that are controlled by the network as their transfer is processed.

The primary effect of the control mechanism is preventative—control over network facilities allows the network to better monitor transactions for opportunism and possibly prevent or modify these transactions. For example, transacting through internet auction websites usually involves the use of centralized servers controlled by the operator of the network. This control enables both monitoring by the operator for opportunistic, usually fraudulent, behavior and prevention of transactions

92. *See* Kranton, *supra* note 18, at 214–17.

93. *See* Oliver E. Williamson, *Credible Commitments: Using Hostages to Support Exchange*, 73 AM. ECON. REV. 519 (1983).

94. For example, such a mechanism exists in the cotton industry. *See* Bernstein, *supra* note 39, at 1737 n.69 ("In addition to paying the annual membership fee, members are required to purchase a membership in the Exchange. The By-Laws provide that when a member fails to pay an arbitration award, the prevailing party has a right to make a claim against his membership. If the noncomplying party still refuses to pay, his membership is auctioned off and the award is paid from the proceeds."); *id.* at 1768 ("[W]hen a transactor is expelled from an association, he must forfeit his membership fee as well as other tangible benefits of association membership such as price sheets, technology circulars, and access to the group's information services.").

95. "Centralized control" means the ability of the network to either monitor or direct activity over facilities used for transacting.

that are likely to be fraudulent.[96] As with the other enforcement mechanisms, the control mechanism may, in certain cases, be employed in bilateral transactions. The investment in creating an independent, centralized transacting facility is typically large so such facilities are rarely formed solely to regulate norm enforcement. Rather, they are typically created to reduce the costs of transacting. An investment in a centralized transacting facility is more economically feasible when the transactions it facilitates are more complex (e.g., involving more parties) and larger in aggregate volume. Because they involve transactions with more parties, transactions on a network tend to be more complex than bilateral transactions, and often the aggregate volume of transacting tends to be larger in networks than in alternative bilateral transacting. As a result, networks frequently have centralized transacting facilities that can facilitate the control mechanism.

*4. Switching mechanism*

The switching mechanism is the replacement of a defaulted transaction with an alternative one, with minimal loss of transaction-specific investment. A network is often able to mitigate the damage caused by opportunistically defaulted transactions by quickly and inexpensively finding an alternative to the defaulting party.[97] The ability to find an alternative transaction not only mitigates the damage from the opportunistic default (by transferring some of the reliance investment in the defaulted transaction to another transaction) but also deters some types of opportunism that are based on renegotiating an agreement with captive customers.

For example, John and Jane are dealers in premium widgets. Premium widgets are very expensive luxury items, and only foolish dealers deal with partners that lack an established reputation. Furthermore, the size of the deal, and therefore the amount of risk a default on it would pose to the injured party, depends on the degree to which the other party's reputation has been established. Therefore, deals with new partners are initially small and grow as the partner's reputation is established. If no network (i.e., exchange) exists, John and Jane would

96. On the actions of internet auction sites to combat opportunism, see James M. Snyder, *Online Auction Fraud: Are the Auction Houses Doing All They Should or Could to Stop Online Fraud?*, 52 FED. COMM. L.J. 453, 460–62 (2000).

97. In the terms and context of the Uniform Commercial Code, this would be considered "covering" for a breached transaction. *See* U.C.C. § 2-712 (2003).

be sensible to concentrate their transactions with each other, building their respective reputations and giving them the assurance required to risk bigger and more profitable transactions. In fact, that is precisely what they did, and John has dealt to date exclusively with Jane. Now, having reached sizable and therefore both very risky and very profitable transactions, Jane reneges on an agreement and offers to renegotiate it in a manner much more favorable to her. She may find it profitable to do so if she, unlike John, has alternative trading partners, or if the stakes in this particular deal are so great as to dwarf her future expected gain from dealing with John. John can either acquiesce to the renegotiated deal or lick his wounds and begin trading with someone else, expending time and foregone profits as he builds his reputation anew.

John could fare better if premium widgets were traded on the Premium Widget Exchange, which, like many exchanges, has an efficient switching mechanism. Reputation is exchange-wide, perhaps because the exchange collects and reliably assesses each member's past behavior, and each exchange member consults with her potential partner's reputation record, which the exchange provides in order to decide whether the potential partner is trustworthy enough for the size of the deal contemplated.[98] Upon Jane's reneging on the agreement, John could, if he were a member of the exchange, easily trade with another exchange member, foiling Jane's attempt to renegotiate. Other exchange members would regard John's reputation as established based on his previous dealings with Jane, which were recorded and positively assessed by the exchange. A distinction should be made between two mechanisms that operated in this example: the information mechanism supplied John's potential trading partners with a credible account of John's reputation; the switching mechanism supplied John with access to several alternatives to transacting with Jane so that upon Jane's default John could inexpensively find an alternative partner to the transaction.

Switching mechanisms are not unique to networks. A switching mechanism has been found to deter opportunism and increase reliance in bilateral relationships in nonnetwork environments.[99] Absent elaborate and accessible reputation-assessing and distributing systems, network transactions may sometimes be more anonymous than bilateral transactions. But when it is feasible for networks to construct such

98. An example of a similar exchange-wide reputation database is eBay's feedback forum. *See* http://pages.ebay.com/services/forum/feedback.html (last visited Nov. 10, 2003).

99. *See* Thomas M. Palay, *Comparative Institutional Economics: The Governance of Rail Freight Contracting*, 13 J. LEGAL STUD. 265, 271–73 (1984).

systems, they have two advantages over other institutions in using the switching mechanism. First, in network environments many investments tend to be network-specific rather than transaction-specific, and therefore they are salvageable through the switching mechanism. For example, the switching mechanism allows partners who have established good reputations to switch trading partners without the cost of reestablishing reputation. The switching mechanism is not as effective in bilateral trading as in a network environment because a trader's reputation must be reestablished each time she loses a partner, whereas in a network the reputation is network-wide and need not be reestablished when transacting with another network member.

Second, because networks usually reduce the cost of identifying partners to a transaction, more alternative partners can be reached and thus the transacting environment is more competitive. Contrast, for example, discrete bilateral agreements to purchase a Pez dispenser with purchasing the same Pez dispenser on eBay. The increased competition and deeper market result in a smaller difference between the defaulted transaction and the next-best alternative. For these two reasons, the switching mechanism tends to be more effective in network environments than in nonnetwork ones.

### *C. Opportunism in Network Environments*

#### *1. Breach*

Most of the literature regarding private ordering addresses opportunistic behavior that shares certain traits: (1) there is a large benefit to the opportunistic party from defaulting on a specific transaction; (2) there is a loss to the same party from potential future transactions that are affected by the default on the specific transaction (or at least a probability of such a loss depending on whether the opportunistic behavior is detected); and (3) the benefit from defaulting on the specific transaction outweighs the losses in future transactions. This Article classifies opportunistic behavior having these characteristics as "breach" in order to distinguish it from another type of opportunism, "degradation," which is described below.[100] A typical example of breach

100. Despite the term's implied relationship to breach in a contracts or torts context, opportunistic behavior of the "breach" type need not involve a legal breach of duty or contract. Nor does it require certainty of, or intent to, default. For example, this Article would consider insolvency to be breach-type opportunism since the potentially insolvent party gains from the specific

is failure to pay: the fraudulent party receives the good or service provided to him without incurring its cost, thereby gaining its value. That party loses future transactions—most likely all future transactions with the party he cheated and possibly also transactions with others who have heard of his actions. He may even lose future transactions with people who do not suspect him specifically but have heard of the fraud and cease to deal with unfamiliar parties due to the increased risk of fraud. When a party chooses to defraud, it would be reasonable to assume that it expects the gain from the specific transaction it defaults on to be greater than the discounted aggregate loss of potential future transactions.

*2. Degradation*

Breach is not the only type of opportunistic behavior in network environments. Another type of opportunism, which this Article calls "degradation,"[101] is unique to network environments. Degradation is a predatory act that weakens the network, harming smaller firms more than larger ones thereby giving larger firms an advantage over smaller competitors. One might view degradation as a form of the strategy known as raising rivals' costs,[102] adapted to prey on firms more dependent on network effects than the degrading firm.[103]

The following example illustrates the goals and effects of degradation: Goliath Corp. 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 in which neither party is a Goliath customer are unaffected. Betty is a customer of David Inc., a small competitor of Goliath. Approximately 70% of the people Betty calls are Goliath customers, correlating with Goliath's market share. This means that if she remains a customer of

transaction on which it defaulted, loses potential future transactions, and imposes losses on other parties with regard to both the defaulted transaction and lost future transactions.

101. This Article follows the term used to describe the same type of behavior in Cremer, Rey & Tirole, *supra* note 74, at 458.

102. On the strategy of raising rivals' costs, see Steven C. Salop & David T. Scheffman, *Raising Rivals' Costs*, 73 AM. ECON. REV. 267 (1983).

103. On degradation in nonnetwork contexts, see Amitai Aviram & Avishalom Tor, *Overcoming Impediments to Information Sharing*, 55 ALA. L. REV. (forthcoming 2003) (manuscript on file with the author). An earlier, working-paper version of the article is available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=435600.

David, 70% of her calls will suffer from static noise. If she switches from David to Goliath, static noise will affect only 30% of her calls, those to non-Goliath customers.

Betty is therefore likely to switch to Goliath. This is precisely the reason Goliath adopted the degradation strategy. Though the quality of its service suffers from the degradation—30% of its calls are of lower quality than before—the degradation hurts the quality of the competitors' services much more because 70% of their calls are affected. The migration of customers to the larger network compensates Goliath for the loss resulting from the reduced quality of its own service caused by the degradation. This strategy is not merely a hypothetical possibility; such strategies have been observed (or at least alleged), inter alia, in the credit card industry,[104] the internet backbone industry,[105] and the telephone industry.[106]

As the David and Goliath example demonstrates, degradation has different characteristics than breach. One significant difference is that the immediate payoff to a degrading party is often negative. For example, when Goliath degraded connectivity with David, Goliath's customers (and indirectly, Goliath itself) were harmed by the static noise present in 30% of their phone calls. However, the act of degradation (Goliath's introduction of static noise in intercompany calls) raised all the network members' costs in transacting over the network or reduced all members' benefits from transacting over the network, which amounts to the same thing. Degradation therefore decreases aggregate network benefits, and the defaulting party stands to gain from the decrease in the efficiency of

104. *See* Amitai Aviram, Accommodating a New Tenant in the House of Cards: Introducing Competition into a Network Industry 24–25, 37–42 (Nov. 2003) (unpublished manuscript, on file with the author).

105. *See* Cremer, Rey & Tirole, *supra* note 74, at 434, 457–60.

106. *See, e.g.*, Goldwasser v. Ameritech Corp., 222 F.3d 390, 395 (7th Cir. 2000) (dealing with customers of incumbent telephone company who 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 Ameritech) in acquiring unbundled elements, and those delays have precluded them from offering services as attractive as [the incumbent's]," and that incumbent "has continued to bill customers of competitors who have converted from Ameritech'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, 611–12, 14 (E.D. Va. 2002) (dealing with entrant phone company alleging, among other things, that incumbent misrouted 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).

the network. Degradation may be feasible when one member of the network is much larger than other members. The demand-side economies of scale and scope, which characterize network environments, cause access to larger networks to be more desirable than access to smaller ones. Therefore, members of a large network are advantaged in competing with members of smaller networks or with firms that are not members of any network. 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.[107] This can be done by excluding others from the network[108] or by degrading connectivity with other members of the network.

When should we expect firms to degrade? In other words, when is degradation a feasible strategy to a network member? Degradation is likely to be a viable strategy only when the degrading firm cannot withdraw from the network since withdrawal would be the equivalent of absolute degradation—zero connectivity with the other former network members. Barriers to withdrawal from the network could be due to legal requirements (e.g., antitrust or regulatory mandates) or due to physical impracticability. For example, railroad companies cannot completely cut themselves out of a network, since the passengers could always walk from one railroad's terminal to another's; however, railroad companies can degrade by refusing to share terminal facilities or by refusing to sell joint tickets, etc.[109]

Two nuances regarding a network member's decision whether or not to degrade should be noted. First, occasionally degradation is feasible against some network members but not against others, such as where reducing connectivity would harm the degrading firm less than some network members but more than other network members. In that case,

107. 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 usually cannot cause market conditions to be as if the network did not exist at all.

108. *See* A. Douglas Melamed, *Network Industries and Antitrust*, 23 HARV. J.L. & PUB. POL'Y 147, 152–55 (1999).

109. *See, e.g.*, Atchison, T. & S.F.R. Co. v. Denver & N.O.R. Co., 110 U.S. 667, 667, 4 S. Ct. 185, 186–87 (1884) (finding that Atchison, Topeka & Santa Fe Railroad refused to "give or take through bills of lading, or to sell or receive through tickets, or to check baggage over" the line of the Denver & New Orleans Railroad).

the degrading firm's competitive position against the less vulnerable firms would be weakened. The degrading firm would prefer selective degradation against the more vulnerable firms while maintaining efficient connectivity with the less vulnerable firms. Second, when the degrader is less vulnerable to small degrees of degradation than its rivals, but more vulnerable to greater degrees of degradation, degradation is unlikely to occur if a degrader can be threatened with exclusion from the network.

Network benefits are not necessarily directly proportional to the amount of connectivity nor are they necessarily identical for all firms. It is possible that by reducing connectivity slightly, the degrading firm will harm itself less than its rivals, but upon a greater amount of degradation, such as complete withdrawal from the network, the situation will reverse and the harm to the degrading (withdrawing) firm will be greater than the harm to the remaining network members. If this is the situation, a firm may wish to degrade without withdrawing completely from the network.[110] However, when a high degree of degradation is harmful to the degrading firm, the sanction of exclusion from the network may be an effective deterrent (depending, among other things, upon the network's likelihood of detecting the degradation and responding by excluding the degrading firm).

Degradation poses different challenges to regulation than breach. One of the traits that makes degradation more difficult to regulate than breach is the difficulty in detecting degradation. Regulating against both breach and degradation poses a difficulty in observing the opportunistic behavior and linking it to the opportunistic party (e.g., spotting the burglar breaking into the house or proving that the static noise on the phone line is the result of Goliath's actions). But degradation is difficult

110. For example, suppose that in the David and Goliath hypothetical, the emergency services (police, fire department, etc.) were David's customers and that the customers would not switch companies even if Goliath degraded connectivity. Goliath's customers do not call those services often; therefore, they remain Goliath's customers even if Goliath introduces static to intercompany phone calls. In other words, the customers prefer to be able to talk static-free in 70% of their calls (yet have some static on the line in the rare event they call the police) over talking static-free in only 30% of their calls, including calls to emergency services. However, while having some static on the line when they call police is acceptable to the customers, being unable to call the police at all is not. Therefore, if Goliath further degrades by cutting out all contact with David customers, or if David responds to the static noise degradation by cutting Goliath off, Goliath's customers will leave Goliath for David and other small rivals because they will prefer to have access to police in case of emergency, even at the cost of not talking on the phone with 70% of their friends. Knowing this, Goliath will not cut David off completely and may not degrade at all if it expects David to retaliate by cutting it off.

to identify even when the actual behavior is observed, since the "correct" degree of connectivity is very difficult to determine.[111] To a significant extent, this is caused by poorly defined duties of connectivity. The ease of detecting breach depends, at least inter alia, on clearly-defined property and contractual rights with respect to the good or service in question. For example, we may observe Ann's default on an obligation to Alice. It would be easy to identify whether this action is opportunistic breach if clear rules determine whether Ann's obligation is binding. The laws of contract and property generally define rights to tangible property more clearly than antitrust law defines rights to access another's network facilities; to use Carol Rose's terms, contract and property law prefer (in most but not all cases) "crystal" rules, while antitrust law prefers "mud."[112]

The looser definition of rights under antitrust law is not due to neglect. It is difficult, particularly for an "outsider" such as a regulator or the courts, to assess what the efficient degree of connectivity should be, especially since the most efficient degree varies widely with the peculiarities of each case. Imposing a duty of absolute connectivity would be meaningless; connectivity could always be enhanced. Thus, degradation might take the form of inaction or failure to upgrade connectivity when efficient connectivity requires upgrading. It is possible not to impose any duty of connectivity, and this policy would be clearly defined, but such a rule would never prevent degradation even where such a strategy is feasible to a specific firm and harmful to social welfare.[113] Lacking a clear guide, courts and regulators often use the status quo as a benchmark and perceive decreases from that level of connectivity as impermissible degradation.[114] While there is some merit

111. This Article assumes that the "correct" level of connectivity is the one that maximizes overall social welfare. While this is the mainstream presumption, it is by no means uncontested. Even if this standard is agreed upon, determining the correct level of connectivity is not simple.

112. *See* Carol M. Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577, 577–78 (1988).

113. *See* POSNER, *supra* note 6, at 251–55 (demonstrating how an exclusion from a network may prolong the existence of a monopoly and therefore be both feasible to the incumbent monopoly and harmful to social welfare).

114. *See, e.g.*, Aspen Skiing Co. v. Aspen Highlands Skiing Corp., 472 U.S. 585 (1985) (condemning a firm's refusal to sell joint tickets with a smaller rival after such joint tickets had been sold for several years); *cf.* Little Rock & M.R. Co. v. St. Louis, I.M. & S. Ry. Co., 41 F. 559, 564 (E.D. Ark. 1890), *aff'd*, 63 F. 775 (8th Cir. 1894). The St. Louis, Iron Mountain & Southern Railroad used to connect at Little Rock, Arkansas with the Little Rock & Memphis Railroad. Upon completing a track of its own to Memphis, SLIM&S Railroad refused to honor through tickets to

to economizing on information costs by deferring to the presumed efficiency of the status quo, this rule of thumb may be misleading, especially in industries characterized by rapid change as many network industries are. In such industries, change may affect the efficient level of connectivity, and yesterday's efficient level, which has been the status quo, may be inefficient today. A connectivity benchmark based on the status quo may punish firms that adjust their level of connectivity to such changes.

While most networks primarily face either one type of opportunism or the other, breach and degradation are not mutually exclusive. It is theoretically possible that some markets would be susceptible to both breach and degradation concerns.[115] Furthermore, in several industries, different aspects of the industry involve different opportunism types. For example, the credit card industry is typically concerned with dishonor (default on credit card payments) and fraud issues, both of which are of the "breach" type.[116] The very same industry, in countries having fewer issuers and merchant acquirers, may be more concerned with larger issuers employing a degradation strategy (e.g., slow and error-prone processing of transactions between themselves and other issuers) to slow the expansion of smaller competitors.[117]

*3. Market structure and opportunism*

Market structure, which is characterized, inter alia, by the number and relative size of network members, significantly affects the type of opportunistic behavior to which an industry is prone. Industries

Memphis using the LR&M Railroad and carried passengers to Memphis over its own lines instead. The court declined to prohibit this action. *Id.*

115. As discussed *infra* Part III.C.3, the type of opportunism an industry is prone to suffer from is significantly affected by the market structure of that industry. Industries with characteristics that are conducive to both breach and degradation may be susceptible to both. For example, it is possible to envision a market with one large firm and many small competitors. The large firm may attempt to degrade against the smaller rivals, while the small firms may commit breach.

116. On fraud rates in credit card and debit card transactions, see Ronald J. Mann, *Credit Cards and Debit Cards in the United States and Japan*, 55 VAND. L. REV. 1055, 1088–93, 1104–07 (2002). On MasterCard's efforts to reduce fraud, see MASTERCARD INC., FORM 10-K FOR THE FISCAL YEAR ENDED DEC. 31, 2002, 16 (2003), *available at* http://www.sec.gov/Archives/edgar/data/1141391/000095012303002592/0000950123-03-002592-index.htm. Fraud is a breach-type of opportunistic behavior because the gain to the opportunistic party from such behavior is derived from the benefits conferred directly on him or her (e.g., purchasing goods with a stolen credit card) rather than indirectly derived from the harm inflicted on a rival as would be the case with degradation-type opportunism.

117. *See* Aviram, *supra* note 104, at 37–42.

consisting of many small firms are likely to suffer from breach; industries consisting of a small number of large firms and industries in which firms have a high vulnerability variance, i.e., wide differentiation in the expected harm to each firm from opportunistic behavior, are likely to suffer from degradation.

The reason for the relationship between firm size and the type of opportunistic behavior is rather straightforward. A breach decreases connectivity by increasing the costs of transacting—including both the losses caused by the breach and the costs expended by nonopportunistic parties to protect themselves from or insure themselves against future breach. Therefore, breach reduces aggregate network benefits. Small network members who breach do not suffer as much from the reduction in such benefits since the burden is divided among all members according to their share of the transaction volume, while the payoff from the fraud goes only to the breaching member. As for degradation, such a strategy is usually only beneficial to larger firms. Smaller firms are likely to be disadvantaged and possibly ineffective in employing a degradation strategy, as they cannot effectively compete alone against larger firms and they are not attractive for other firms to connect with.

The relationship between the vulnerability variance in an industry and the risk of degradation stems from the driving motive for degradation—raising the costs to one's rival more than the rise in one's own costs in order to gain a competitive advantage over the rival. Naturally, degradation is more profitable the greater the difference in vulnerability between the degrading firm and its victim. When all firms suffer the same harm from degradation, no firm will attempt to degrade, since the degrading firm will not gain anything from it. As disparities in vulnerability to degradation increase, so does the payoff from degradation to the degrading firm. The greater the payoff, the more likely and more frequently degradation will occur.

Market structure has an effect not only on the type of opportunistic behavior to which the market is more susceptible but also on the ability of a network to regulate conduct in order to mitigate opportunism. This relationship will be explored below[118] following a short examination of how opportunism, both breach and degradation, affects social welfare.

118. *See infra* Part IV.C.

*4. Social welfare effects of opportunism in network environments*

Breach and degradation may differ in their effects on social welfare. Social welfare is an aggregate measurement of the well-being of all individuals within society.[119] An action that increases the well-being of one or more individuals in society without decreasing the well-being of any other members clearly increases social welfare. The assessment of effects on social welfare becomes much more difficult when an action increases the well-being of one individual at the same time it decreases the well-being of another. Such assessment would require rules governing the aggregation of individuals' well-being, including determining the relative weight each individual's well-being receives;[120] whether any of an individual's preferences should not be considered in the aggregate;[121] and quantifying the diverse range of preferences that affect one's well-being.[122] Reaching an actual number that measures the social welfare is a difficult, if not impossible, task. The number of abstractions and approximations needed to reach it would likely make such a figure useless. However, it is much easier to reach rough approximations regarding the effect of actions on social welfare, and these approximations, while not exact, are easy to assess and can provide important insights as to which actions are "better" in the sense of making society as a whole better off.

This section will make such an approximation of the effects of breach and degradation on social welfare. The risk of breach raises the cost of transacting and therefore leads to a decrease in the number of

119. *See* Louis Kaplow & Steven Shavell, *Fairness Versus Welfare*, 114 HARV. L. REV. 961, 985 (2001). For a formal expression of social welfare, see *id*. at 985 n.42.

120. The utilitarian model of social welfare gives the same weight to each individual's well-being. Some scholars object to this assumption by calling for preferential or even exclusive consideration of the well-being of the worst-off individuals. For a concise discussion of views on this matter, see *id*. at 987–88; David A. Weisbach, *Should Legal Rules Be Used to Redistribute Income?*, 70 U. CHI. L. REV. 439, 442–43 (2003).

121. For example, one may argue for or against including hateful preferences, such as wishing someone else harm, in the calculus of social welfare. *See* Weisbach, *supra* note 120, at 442.

122. Quantifying preferences is difficult because many of them are nonpecuniary and in many cases even the individual herself does not have precise values attached to her preferences. Despite the difficulty, measuring only material preferences would significantly reduce the value of a social welfare calculus by making it less connected to an individual's actual well-being. *See, e.g.*, Richard A. Posner, *Wealth Maximization and Tort Law: A Philosophical Inquiry*, *in* PHILOSOPHICAL FOUNDATIONS OF TORT LAW 99 (David G. Owen ed., 1995) ("The non-pecuniary dimension of wealth is important to emphasize, especially to non-economists, who are prone to assume that economists care only about goods and services that are priced in the market. Yet I concede the incompleteness of 'wealth,' even when so broadly defined, as a measure of social welfare.").

beneficial transactions that take place. To illustrate, think of the reactions of people who trade on eBay when they learn of a surge in instances of fraud on the network. Individuals who are more risk-averse may stop trading on eBay. This would reduce utility not only for them, but also for the remaining traders who lose potential trading partners. Furthermore, parties to the remaining transactions may take action to decrease the risk of breach, and the cost of these actions further decreases social welfare. In the eBay example, the individuals who still trade on eBay may require payment by credit card, ask for collateral, or run extensive checks on their trading partners, all of which bear a cost.

Complete prevention of breach may result in the enforcement of some inefficient deals since, if the network is successful in preventing all breaches, a member might not be able to "buy" its way out of an inefficient deal. However, there is good reason to believe that the regulator will be able to identify and allow efficient breaches.[123] Also, due to the degree of reliance on deals in a network (which increases the social cost of breach), efficient breaches are likely to be uncommon in comparison with inefficient breaches.[124] Furthermore, a firm that repeatedly finds itself committed to inefficient deals can opt out of the network.

Assessment of the effects of degradation on social welfare is different. Degradation lowers the utility of interconnection or imposes

123. The regulator may require a portion of the gain from the efficient breach in order to allow it. It would, however, be in its interest not to demand a portion so large as to induce the firm not to commit efficient breach.

124. The following fact pattern illustrates why greater reliance reduces the likelihood of efficient breach. Alice and Ben sign a contract by which Alice will sell Ben her house for $100,000. This contract is good for both because Alice needs to relocate and therefore currently derives only $80,000 from the house, while Ben would receive $120,000 of utility from the house if he owned it. Before they close the deal, Carol persuades Alice to breach the contract with Ben and sell the house to her (Carol) for $130,000. This is good for both Alice and Carol. Alice receives $30,000 more than she would under the contract with Ben and Carol likes the neighborhood more than Ben does and would derive $150,000 of utility from the house if she owned it. The total utility under the Alice-Ben contract is $40,000. Alice gets $100,000 in return for an asset she values at $80,000, and Ben gets an asset he values at $120,000 in return for $100,000. The utility under the Alice-Carol contract is $70,000. Alice gets $130,000 for an asset she values at $80,000, and Carol gets an asset she values at $150,000 in return for $130,000. Therefore, if neither Alice nor Ben relied on the original contract, then the breach may be efficient. But suppose Ben, in reliance on the contract, sold his previous home, left his old job in favor of a job closer to the home he thought he was buying, and made other changes that will cause him a loss of $50,000 if he does not receive the house. In that case we must deduct $50,000 from the total utility under the Alice-Carol contract, bringing the total benefit down to $20,000, which is less than the $40,000 to be gained from the Alice-Ben contract. Therefore, the greater the parties' reliance on the Alice-Ben contract, the more likely a breach thereof would be inefficient.

costs on it, thereby decreasing network benefits. This reduced utility or added cost leads to a decrease in the number of beneficial transactions that take place on the network. This results in a loss, not only to the parties that no longer find a transaction gainful after the added risk of degradation, but also to all network members who share in the loss of network benefits due to the decrease in transacting over the network. The added risk of degradation and the decrease in network benefits may cause some members to cease transacting through the network, perhaps seeking relative advantage by creating an alternative network in which members do not degrade or perhaps withdrawing from the market altogether because their small size does not enable them to compete. This reduction of transactions over the network further decreases network benefits and, if it results in less competition, also increases the deadweight loss.[125] All of these effects reduce social welfare.

Not every unilateral reduction in connectivity is degradation. Some actions that reduce connectivity do not reduce net social welfare and are not a form of degradation. Added connectivity is not always welfare-enhancing. Like supply-side economies of scale, network effects may peak at a certain level. Above that level, more connectivity may reduce social welfare for reasons such as the cost of the added complexity. Therefore, connectivity above the maximum efficient scale of the network may be welfare-reducing even if it is costless to enforce. Furthermore, preventing a reduction in connectivity has costs as well. A prohibition of any reduction in connectivity is akin to an open-access requirement. Like open-access mandates, a limitation on the ability to reduce connectivity decreases the incentive of network members to invest in growing since the open access allows competitors to free ride on their success. As a result, incentives to compete among network members decline.[126] Another concern with prohibiting degradation is that to make such a prohibition meaningful, someone needs to prescribe what the "right" level of connectivity is, from which a decrease would be

125. The deadweight loss is a loss of social welfare resulting from the use of market power to restrict output and raise prices. A deadweight loss increases as competition decreases. On deadweight loss created by reduced competition, see HERBERT HOVENKAMP, FEDERAL ANTITRUST POLICY: THE LAW OF COMPETITION AND ITS PRACTICE §1.3b (1994).

126. *See* Little Rock & M.R. Co. v. St. Louis, I.M. & S. Ry. Co., 41 F. 559, 564 (E.D. Ark. 1890) ("Competing lines afford the best and surest protection the public can have against oppressive rates . . . . Is it, under these circumstances, an unfair or unjust preference or discrimination for the defendant, in the sale of tickets, to prefer its own line to that of the plaintiff? If it is, the incentive to the construction of competing lines will be very much lessened.").

considered degradation. As discussed above,[127] the study and constant monitoring needed to assess the "correct" level are very costly, and, as with all forms of price or access pricing regulation, it is subject to a significant risk of error and to wasteful expenditures of resources on influencing the regulator.

Can government rely on the quality of connectivity prescribed by the network and lend its enforcement mechanisms to impose those standards? This depends on whether networks treat welfare-reducing degradation differently than welfare-enhancing reductions in connectivity. At the time the alleged degradation takes place, the network is likely to condemn any reduction in connectivity regardless of its effects on social welfare, just as it does not distinguish between cheating a partner to a transaction and cheating a cartel. Both formally seem to be "breach," though the latter is welfare-enhancing and therefore not viewed as opportunism. However, at the time of forming the network and determining the duties of its members, networks are likely to determine an efficient level of connectivity, i.e., allow "efficient degradation" which is not degradation at all. There would still be a problem when changing circumstances modified the efficient level of connectivity. Absent government intervention, the network might renegotiate its obligations. But when private sanctions are ineffective, lack of government intervention would allow the large firm to degrade. Therefore, independent government assessment of the "correct" level of connectivity should be appropriate where (1) the network is an inefficient regulator against degradation either because it lacks the ability or the incentive to prohibit degradation; (2) circumstances have changed since the formation of the network so that the efficient level of connectivity has changed; and (3) analysis of the practice that allegedly amounts to degradation indicates that it reduces social welfare.

## IV. NETWORKS AS EFFICIENT REGULATORS

### *A. Comparing Regulators*

Part II.B of this Article discussed the various potential regulators and assessed the advantages and disadvantages of each. After discussing network effects and the enforcement mechanisms that utilize them, one can better assess some advantages networks possess in regulating. This

127. *See supra* Part III.C.2.

section will focus on networks' ability to prevent some norm violations, and on networks' ability to form and employ a common culture to reduce the costs of enforcing norms.

*1. Overview of potential regulators*

As mentioned above,[128] several entities may act as regulators: first-party regulators (self-regulation), second-party regulators (transaction regulation), network regulators, and government regulators. Self-regulation assigns the role of regulator to the entity with both the greatest ability to detect and prevent opportunistic behavior as well as the least incentive to regulate. Self-regulation is also highly susceptible to self-deception and discrepancies in culture and personal morality. Transaction regulation benefits from the familiarity of the parties with the regulated transaction and their ability to monitor it closely, but suffers from weak sanctions against offending parties. At the other end of the spectrum, furthest away from opportunistic behavior, is government regulation, which benefits from relatively powerful sanctions but which entails significant monitoring costs as well as significant costs of error.

Network regulation is an alternative to self-regulation, transaction regulation, and government regulation. Networks often have a monitoring ability comparable to or surpassing that of the parties to the transaction. Networks' strongest sanction—exclusion from the network—may be a greater deterrent than governmental sanctions. This is especially true where law enforcement is lacking or the threat of imprisonment is insignificant.[129]

*2. Networks' ability to prevent norm violation*

One advantage network regulation can have over its government counterpart is the ability to *prevent* some forms of opportunistic actions rather than prohibit and punish as the government does. The control mechanism in some cases enables the network to intercept and block transactions that are deemed unwanted. For example, eBay can delete listings of illegal items from its website. In addition to deterring opportunistic behavior, the switching mechanism can also prevent such behavior by preventing would-be victims from becoming captive to an opportunistic party. The exclusion mechanism, while punishing and

128. *See supra* Part II.B.

129. *See supra* note 25.

deterring, also prevents opportunists from trading opportunistically in the future in industries where most trading is done on an exchange.[130] Government's arsenal of sanctions includes fines, injunctions, and incarceration. Fines deter and punish but do not prevent the harmful behavior. Neither does injunctive relief, since it does not physically prevent the harmful behavior but merely attaches a punishment thereto.[131] The only preventive remedy the government has is incarceration, which not only punishes and deters but also physically prevents the opportunistic party from violating most norms while incarcerated. However, as mentioned above, incarceration is likely to be imposed upon only the most egregious norm violators.

Forms of regulation that physically prevent a would-be opportunist from acting in a harmful way rather than deterring or punishing such behavior can be analogized to rules of physics, which, unlike rules of law, cannot be broken.[132] The possession of such "rules of physics" gives networks a significant advantage over other potential regulators. Like rules of physics, however, these mechanisms are difficult to artificially create—they will not exist if efficient market structure dictates that a given network does not have the ability to track and block transactions or if many transactions in a given industry are done outside of networks. In contrast to rules of physics, rules of law are easier to artificially impose where they did not exist before.

*3. Networks and common culture*

Another advantage that some networks possess is a common culture shared by members. Common culture reduces costs involved in regulation in several ways. Since it creates a sense of belonging, it

130. For example, if John habitually defrauds his transacting partners, the exclusion mechanism would first serve to deter him from doing so as he recognizes that getting caught and excluded would impose serious costs on him. But if deterrence fails and John commits fraud, his exclusion from the network would prevent him from harming other network members.

131. An injunction is a threat of court sanction if the court's order is violated. As such, additional enforcement costs are required to enforce the injunction (e.g., detection of the violation, proving the violation in contempt proceedings, etc.). Even then, to prevent a given conduct the penalty must either be incarceration (because fines would merely put a price tag on the violation) or it must be targeted not at the violator but at a private entity that has the ability to physically prevent the violator's conduct (e.g., requiring eBay to delete listings of illegal items). The former alternative is unlikely—one who violates an injunction but who does not pose a physical threat is rarely incarcerated. The latter merely commandeers network regulation.

132. For an extensive discussion of regulation through "rules of law" and "rules of physics," see LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE 85-89 (1999) (using the term "architecture" to regard the various "rules of physics" methods of regulation).

widens the scope of services provided by the network to include social gratification. Therefore, the deterrence effect of exclusion from the network is greater because exclusion entails not only loss of business with network members, but also loss of social standing. Common culture also provides members with knowledge about matters relevant to the business transacted over the network and standardizes this knowledge among the network members, thus reducing information asymmetry. Further, a common culture creates a unique good—esteem or social standing in the group—which can be a powerful motivator to follow the norms of the group.[133] Common culture may also add a psychological element to the enforcement of norms because a violation of the norms of one's social group with which one empathizes or identifies may be perceived by oneself and by others as more morally wrong than violating the norms of more distant peoples or groups. Moreover, membership in a network may induce a sense of kinship that would increase the guilt associated with violating a norm that harms one's "kin," and may eliminate the ability to justify norm violation with an antipathy to "outsiders."[134] For all these reasons, common culture reduces the cost of enforcing norms.

It is therefore unsurprising that networks and other institutions have attempted to create common cultures that facilitate the underlying business transactions.[135] Part of the value in belonging to a common culture, however, is the difficulty in artificially producing it. The difficulty in finding or creating an alternative, equally attractive social group is what makes membership in the current group so valuable. It is difficult to create a common culture where there was none before, but if

133. *See* Richard H. McAdams, *Cooperation and Conflict: The Economics of Group Status Production and Race Discrimination*, 108 HARV. L. REV. 1003 (1995).

134. On guilt alleviation as an incentive to cooperate and reciprocate good behavior, see Lior Strahilevitz, *Charismatic Code, Social Norms, and the Emergence of Cooperation on the File-Swapping Networks*, 89 VA. L. REV. 505, 563–67 (2003).

135. *See, e.g.*, Bernstein, *Private Commercial Law*, *supra* note 30, at 110 ("[Trade associations] have also encouraged the emergence of informal information channels by creating opportunities for social interaction among members and their families. Many associations sponsor clubs for spouses and host regular sporting events and gala dinners. . . . They also link social reputation to commercial reputation, thereby increasing the cost to transactors of sacrificing reputation bonds and giving them stronger incentives to abide by their commercial commitments."); Bernstein, *Opting Out*, *supra* note 30, at 130 ("Another enforcement mechanism sometimes invoked by the arbitrators is a proceeding in Jewish rabbinical courts against the party who refuses to comply. Because these courts have the authority to ban an individual from participation in the Jewish community, this is a powerful threat against Orthodox members of the diamond industry."); *see also* Landa, *supra* note 45.

an existing cultural network exists it may expand its role and act to mitigate opportunism in business transactions, exploiting its enhanced ability to regulate.[136] As addressed in the next section, when networks have the ability to be the efficient regulators, they often reform to accept that role.

### *B. When Are Networks Optimal Regulators?*

Below I will discuss when networks are the optimal regulators. This depends on the network having comparative advantages in both the ability to regulate and in the incentive to do so. When this is not the case, other potential regulators are likely to displace the network unless the network adapts to improve its ability and/or incentive. This adaptive qualification will be addressed at the end of this section.

#### *1. Networks' ability to regulate*

The mechanisms that networks use to regulate—the switching mechanism, the exclusion mechanism, the control mechanism, and the information mechanism—were described above. The effectiveness of these mechanisms, and therefore the effectiveness of the network as a regulator, is dependent on the market structure.

The effectiveness of a network's switching mechanism is greater in markets that are characterized by significant network benefits and low concentration. As concentration rises, the market becomes more susceptible to collusion; the network's prices are less likely to mimic a perfectly competitive market, and fewer alternative firms are available to contract with when a transaction fails.

Similarly, the effectiveness of a network's exclusion mechanism is greater in markets that are characterized by significant network benefits and low concentration. The greater the network benefits, the greater the value conferred on the network member, and therefore the greater the cost of canceling the membership in the network.[137]

136. *See* Aviram, *supra* note 9.

137. For a similar point, see Bernstein, *Private Commercial Law*, *supra* note 30, at 111 ("When market transactors share a common view about what constitutes acceptable business behaviour, a given instance of misbehaviour will result in more transactors imposing the sanction. . . . It gives transactors an added incentive to abide by their commercial commitments by making it in each transactor's individual best-interest to perform rather than breach over a wide range of contingencies and market conditions.").

Larger firms, however, are less threatened by exclusion. First, the larger the firm the greater the loss to the network from its exclusion since the size of the network decreases significantly and with it the network benefits. The network's threat of exclusion is less credible the greater the loss it suffers from the exclusion. Second, some firms may be large enough to become indispensable to other firms, and therefore exclusion from the network may force those dependent members to contract with the excluded firm. This decreases both the volume of transactions processed through the network (thereby further harming network members) and the amount of business the excluded firm is deprived of. Third, as mentioned above,[138] large firms may actually find it profitable to adopt a degradation strategy under which the firm weakens the network in order to gain an advantage in competing against smaller firms. Exclusion from the network is the ultimate form of degradation since it degrades to nothing the connectivity with the excluded firm and therefore would be a boon, not a bane, to large firms that benefit from degradation.[139]

The information mechanism is an extension of the exclusion mechanism and decreases in effectiveness in similar situations: private parties are less likely to boycott larger firms, even if provided with credible information by the network, because the harm from boycotting a larger firm tends to be greater. Specifically, large firms tend to have more captive partners who find it very costly to switch away from the large firm and are therefore less likely to do so.

Finally, the control mechanism is also more efficient in markets that are characterized by significant network benefits and low concentration.[140] The control mechanism is effective when the network's transacting facilities cannot be feasibly replaced by opportunistic members. If the transacting facilities can be easily replaced, then the opportunistic members can do so immediately before behaving

138. *See* Cremer, Rey & Tirole, *supra* note 74 and Part III.C.2.

139. Some large firms do not benefit from degradation because network benefits gained from operating within the network outweigh the possible benefits of competing against a degraded network. For such firms, the third argument regarding the effectiveness of the exclusion mechanism would not apply, and perhaps the threat of exclusion will deter them from breach. However, the other two arguments (regarding the credibility of the threat to exclude and the "stranded partners" that cannot stop transacting with the firm) still apply and may weaken the network's ability to discipline that firm's behavior.

140. Some networks have a decentralized structure that does not involve centralized control of transacting facilities. In that case, the control mechanism will not be available regardless of network benefits or the size of firms in the market.

opportunistically (to evade the network's ability to monitor and prevent the behavior) or immediately after behaving opportunistically (to null the effect of the network's denial of access to the facilities). Creating independent transacting facilities has the same effect as being excluded from the network, and therefore the effects of network benefits and firm size on the effectiveness of the control mechanism are the same as those mentioned in the discussion above on the exclusion mechanism. The greater the network benefits conferred by the network, the larger the difference between it and any alternative facility created by the opportunistic member. In sum, networks' ability to regulate should increase as network benefits rise and the size of the firms in the market decreases.

*2. Networks' incentive to regulate*

Opportunism, broadly defined, is "an act in which someone destroys part of the cooperative surplus to secure a larger share of it."[141] Regulation is aimed at mitigating opportunism, yet no potential regulator has the incentives to always deter opportunism. First-party controllers (self-regulators) have perhaps the least incentive to regulate efficiently since the regulator is also the would-be opportunist and is likely to be the direct beneficiary of the opportunistic behavior it is regulating. Second-party controllers (transaction regulators) are directly affected by any opportunism targeted at them but do not care about the effects on others. Therefore, they do not have a sufficient incentive to regulate efficiently when opportunism imposes externalities on others. They may even regulate in a way that benefits them but harms others, as may be the case with cartels, group boycotts, etc. Government has broader incentives, usually extending to the interests of all its constituents. However, the incentives are indirect. As public-choice theory observes, the interests of certain constituents influence government more than others. Government may also have other interests besides mitigating opportunism that might conflict with efficient anti-opportunism enforcement.[142]

141. Cooter, *supra* note 12, at 150.

142. For example, as mentioned *supra* note 25, the government's interest in deterring violent crimes and the need to assign sanctions in proportion with their gravity require that government not use its most powerful sanctions against persons who act opportunistically in business transactions since this is considered a significantly less serious crime than murder or rape. If private parties can rely on the government to deter the more serious crimes, private parties will impose the strongest sanctions they have against less serious, but still harmful, behavior such as opportunism in business transactions.

Networks have similar incentives to those of the parties to the transaction. Being a larger group, the array of interests networks are concerned with is broader than that of transaction regulators. Unlike the government, the network is directly affected by opportunism, since opportunism usually decreases network benefits and reduces activity and reliance on the network. Like transaction regulators, networks may disregard, or even exploit, the interests of nonmembers. The literature has termed this "the dark side of private ordering."[143] For example, some networks discriminate on the basis of race, ethnicity, gender, or other characteristics. In certain cases (typically where government regulation is lacking), networks utilize physical violence as a sanction.[144] More commonly, they may attempt to create, enhance, or maintain the market power of their members.

The possession of market power by a network, or the ability to maintain that market power, significantly biases the network's incentives. The same mechanisms that are used to mitigate opportunism can be used to facilitate collusion. From the perspective of the network members, but not, of course, from the perspective of overall social welfare, cheating on a cartel agreement is no different from defrauding. Both reduce the benefits to network members, and the prevention of both is beneficial to the network.

Stephen Pirrong points to other potential biases that may cause networks to lack the incentive to regulate in a socially efficient manner.[145] First, collective-action problems and rent-seeking among network members impair incentives to self-regulate.[146] Second, some types of opportunism mainly affect inframarginal customers of the network, while the network members' wealth depends on the marginal customers.[147] The strength of these arguments seems to be highly

143. *See* Milhaupt & West, *supra* note 35. Other scholars refer to this as the "downside" of private ordering. *See* Ellen D. Katz, *Private Order and Public Institutions*, 98 MICH. L. REV. 2481, 2482–85 (2000); McMillan & Woodruff, *supra* note 35, at 2454–58.

144. Milhaupt & West, *supra* note 35, at 93 ("[I]n the absence of workable legal mechanisms, enforcement requires credible threats of physical violence: state coercion must be privatized.").

145. Stephen Craig Pirrong, *The Self-Regulation of Commodity Exchanges: The Case of Market Manipulation*, 38 J.L. & ECON. 141, 150–64 (1995).

146. *Id*. at 157–64.

147. Pirrong makes two other arguments as well: (1) networks may not face significant competition and therefore may lack the incentive to improve efficiency in transacting through the network, *id*. at 154–55; and (2) there is a significant negative externality on nonmembers who rely on price information from transactions on the network, *id*. at 151–54. Both of these arguments suffer from flaws.

The argument regarding lack of competition among networks is unconvincing because even if

dependent on the characteristics of the specific network. Pirrong's focus, for example, was on commodity exchanges. Even in instances where such arguments have validity, this only means that networks are imperfect regulators. As seen above, the government—as well as any other potential regulator—suffers from imperfections in its incentives and ability to regulate. Networks may therefore be the most efficient regulators even where they suffer from some bias in their incentives.

Furthermore, as described below,[148] networks adapt to biases that hinder regulation by evolving through middleware into a network with either decentralized control or centralized control by a firm that does not possess market power either alone or with others in the network.[149] Typically, this is because the "hub" firm that controls the expanded network does not operate in the industry in which the market-power-possessing members operate—for example, an express company in the hub of a network of railroads or a programming language in the hub of a network of operating systems, etc.[150]

a network faces no competition it would still view opportunism that harms its customers as a cost rather than a monopolistic rent (unless it profits the network itself, which would make the "opportunistic" action an exploitation of market power by the network rather than an opportunistic act done over the network). If opportunism is a cost, a monopolist would have an incentive to mitigate it and replace it with outright extraction of monopolistic rent as long as the cost of mitigation is lower than the loss of profits from the decline in demand due to this cost. However, one instance in which this would not be the case is where the network is regulated by government and limited in its ability to receive payments from its customers. In that case the monopolist would have no incentive to diminish opportunism. Furthermore, in the case of such regulation, to the degree that this opportunism is beneficial to the network members, the network might favor opportunism as a form of "gold plating" evasion of regulatory caps on rent extraction. But this seems not to be the common case with most networks.

Regarding the reliance on price information, nonmembers should, and probably do, take into account the degree of opportunism policing when they decide whether and to what extent to rely on the network or the information it generates. If a network is the institution with the best ability to mitigate opportunism but lacks the incentive to self-regulate efficiently, nonmembers will seek a more accurate indicator, rely less on the price information, or pay the network in order to self-regulate.

148. *See infra* Part IV.B.3.

149. The network possessing market power may attempt to prevent middleware from forming or from connecting to the network since the network benefits more from maintaining its market power than from enhancing regulation.

150. Perhaps the popularity of industry-sponsored networks in some industries, and of independent networks in other industries, may be explained by the need (in the latter group of industries) to create a network that is free of market power bias in the incentive to regulate. This issue may warrant significant additional attention that exceeds the scope of this Article.

*3. Networks' resilience: the role of middleware in making networks better regulators*

As noted above,[151] there is a demand for efficient regulation. This demand allows networks to displace other institutions, such as the parties to the transaction or government, where the network is the more efficient regulator. Similarly, when networks are not efficient regulators, demand for regulation creates pressures to replace the ineffective network with other institutions. However, networks are very resilient and, in response to a demand for regulation, often adapt to a form that is better suited to mitigate opportunism.

This adaptation often takes the form of an institution recent antitrust case law and literature has called "middleware."[152] Middleware is a facility that connects two independent networks in order to maintain access between those networks. It can be analogized to a hub, the spokes of which are independent networks and the purpose of which is to combine the independent spokes into a single network.

Middleware has been discussed in depth in the context of the Microsoft trial.[153] In that context, the middleware was software (such as Sun's Java and Netscape's Navigator) that could operate on various operating systems while allowing application developers to develop applications operating thereon. An application written for the middleware would then operate on any of the various operating systems that supported the middleware. Thus, the middleware would connect independent networks or operating systems, allowing one application to operate on all.

Much of the discussion in the Microsoft trial and in the literature that analyzed middleware in the aftermath of that trial examined the effects of middleware on market power and market definition. Market power may be a cause of the demand for middleware because it biases the existing network's incentive to regulate efficiently. For example, software application programmers may create a demand for middleware such as Java out of concern that if their software application cannot be used on several operating systems, Microsoft would extract the surplus value they

151. *See supra* Part II.A.

152. *See, e.g.*, United States v. Microsoft Corp., 87 F. Supp. 2d 30 (D.D.C. 2000), *rev'd in part*, 253 F.3d 34, 53–54 (D.C. Cir. 2001), *cert. denied*, 534 U.S. 952 (2001); Howard A. Shelanski & J. Gregory Sidak, *Antitrust Divestiture in Network Industries*, 68 U. CHI. L. REV. 1 (2001).

153. *Microsoft*, 87 F. Supp. 2d at 30.

create by raising the price of its operating system.[154] But there may be other reasons for the emergence of middleware, such as limitations to the current networks' ability—rather than incentive—to regulate. A key utility of middleware is its ability to ensure efficient connectivity between formerly independent networks.[155]

It seems that one of the benefits of the middleware discussed in the Microsoft trial, though certainly not the only benefit and perhaps not the most important one, was its ability to allow a single application to operate on several operating systems.[156] Arguably, the market power possessed by Microsoft's Windows operating system biased its incentive to regulate efficiently, perhaps instead giving it an incentive to attempt to maintain or enhance its market power by excluding or degrading. On the other hand, middleware such as Java or Netscape Navigator did not possess market power and therefore had an unbiased incentive to enforce norms efficiently ("norms" in this context may perhaps mean choice of efficient technical standards rather than technical standards that are suboptimal but which exclude rivals).

Middleware may also emerge when existing networks lack the ability to properly regulate. This seems to have been the case, for example, with an older type of middleware—express companies.[157] These companies formed in the mid-nineteenth century when traveling a significant distance by train required connecting through many small railroads. A small number of railroads operated in each region, making a regional network less effective as a regulator.[158] Express companies took upon

154. If the software application can be used on several operating systems, Microsoft cannot extract the surplus value because if it raised the price of Windows, people would use the application on another operating system. For example, if a new financial planning program was worth $100 more to every user than the next-best software of the same type and that financial planning program only worked on Windows, Microsoft could raise the price of Windows by $100 and users would still buy it since users would require Windows in order to benefit from the financial planning software. If, on the other hand, the financial planning software was written in Java and could be used on Windows as well as other operating systems, a $100 price increase in Windows would cause users to abandon Windows and use the financial planning software on another operating system. The application software writer could then raise the price of the application to capture the surplus value it has created.

155. Middleware often has other functional utilities that have nothing to do with regulation. For example, the internet browser serves as an interface between the user and the internet.

156. *Microsoft*, 253 F.3d at 34, 53 (explaining how middleware allows an application to operate on several operating systems and discussing the potential competitive significance).

157. *See* Dennis W. Carlton & J. Mark Klamer, *The Need for Coordination Among Firms, with Special Reference to Network Industries*, 50 U. CHI. L. REV. 446, 454–60 (1983).

158. As discussed *supra* Part IV.B.1, high concentration (i.e., a market composed of a few large firms) reduces a network's ability to regulate. It is noteworthy that there was another obstacle

themselves to deliver freight and coordinated among the railroads that carried that freight. As Dennis Carlton and Mark Klamer point out, express companies offered this coordination until railroad companies consolidated and were able to offer comparable coordination.[159]

The resilience of networks is not without limits. As discussed above,[160] network effects may to some extent raise barriers to entry, meaning some "biased" networks would not be replaced by smaller unbiased alternatives. However, even if proponents of inefficient lock-in are correct in their analysis, the barriers to entry raised by network effects are not infinite, and therefore biased networks' fear of being replaced by nonbiased alternatives serves as a check on the degree to which they use their ability to regulate in a manner that is socially inefficient.[161] Another limit to the resilience of networks stems from the evolutionary pattern by which they develop. The creation of PLSs is often not spontaneous but rather develops in phases; initially the PLS regulates very few, cooperative (and therefore easy to enforce) functions, and only later does the PLS expand to enforce more rivalrous norms.[162] Impediments to the creation of PLSs may slow the entry of network regulators and this delay, if it is sufficiently long, may force parties to enter into transaction regulation, including horizontal and vertical

to self-coordination by the railroads due to a possible bias in incentives caused by possession of market power. There were not many railroads competing from any given destination, and therefore many of the railroad companies possessed some market power.

159. Carlton & Klamer, *supra* note 157, at 457 ("Some of the uniform operating procedures were spurred by outside competition. During the thirty-year period beginning in 1850, independent freight companies, such as Wells Fargo, began to serve as intermediaries between railroads and customers who desired to ship goods. These freight companies handled the complicated transactions with all the different railroads. . . . By the 1880's, the railroads had little need for freight express companies."). On consolidation as a response to the need for greater coordination, see ALFRED D. CHANDLER, JR., THE VISIBLE HAND: THE MANAGERIAL REVOLUTION IN AMERICAN BUSINESS 81–82, 89 (1977).

160. *See supra* note 68.

161. For example, even if network effects benefiting users of Microsoft Windows would allow Microsoft to design its operating system in a way that is suboptimal to the consumers but that suppresses the emergence of middleware and competing operating systems, there are limits to the disutility Microsoft could inflict. At some point, the disutility of the design would more than offset the utility of Windows's network effects for some marginal users, and they would abandon Windows for a rival. This, in turn, would reduce Windows's network effects, making other users decide to switch operating systems, which would reduce network effects yet again, ultimately resulting in the market tipping to another network. Similarly, a social network might adopt norms that are inefficient but exclude a certain group to the advantage of the network's members. But if the norm is grossly inefficient, another group would form with more efficient norms and would be able to recruit members despite its disadvantage in network effects, due to the greater efficiency of its norms.

162. *See* Aviram, *supra* note 9.

integration that affects market structure. For example, excessively strict antitrust regulation may prohibit welfare-enhancing information exchanges or trade association rules that reduce opportunism.

It is also important to note that middleware is not necessarily welfare-enhancing. For example, it may free ride on investments in the independent networks it connects. However, where network regulation can be efficient, but the existing network lacks the incentive or ability to regulate efficiently, middleware is likely to appear in response to demand for welfare-enhancing regulation.

It is worthwhile to observe the dual effect that middleware has on a network's ability to regulate. On one hand, as discussed at length above, middleware has the effect of strengthening the network's incentive to regulate efficiently. Since the incumbent network is threatened by entry or expansion of middleware if it does not regulate efficiently, it is either "kept honest" by the middleware or displaced by it. On the other hand, middleware weakens the network's ability to regulate as it undermines the exclusion mechanism; exclusion from the network does not deprive a member of network benefits since the middleware provides them. The control mechanism is also often undermined; tracking behavior on the network's central facilities is not helpful if the central facility can be bypassed by using the middleware, especially if the middleware is more lenient in its enforcement or if the middleware abides by and enforces different norms. This dual effect makes it impossible to assess as a general matter whether middleware increases or reduces the ability of networks to regulate in a social-welfare-maximizing manner.

### *C. Market Structure and Regulation*

As mentioned above, this Article offers but an initial observation, intended to guide future detailed empirical examination of the utilization of network effects in creating institutions that mitigate opportunism. This section takes a first step on this empirical journey with a glance at anecdotal evidence that supports the predictions of the theory espoused in this Article.

Part III.C of this Article explained why markets with low concentration—i.e., containing many small firms—are prone to suffer from the breach type of opportunism, while markets with high concentration and high vulnerability variance are likely to suffer from degradation. Part IV.B observed that, given the incentive to do so, networks are likely to be efficient regulators in markets characterized by significant network benefits and low concentration.

A very brief and preliminary look at a few network industries seems to support these expectations. The diamond exchange industry, the cotton exchange industry, and internet auction websites all involve many relatively small firms and significant network benefits. It seems the main opportunistic threats these industries are concerned with are of the breach type, i.e., primarily fraud and insolvency. In these circumstances, we would expect networks to be good regulators. In fact, networks do indeed take active roles in monitoring, deterring, and punishing breach in each of these industries.[163] Government regulation is not as intensive; none of these industries is closely regulated, and though the FTC is active in prosecuting internet fraud, the larger internet websites, such as eBay, take a leading role in instituting antifraud mechanisms.[164]

On the other hand, the internet backbone industry and the credit card industry (in certain countries) tend to be dominated (in each relevant geographic market) by a few large firms. In many regions, the pre-regulation (i.e., nineteenth-century) American rail industry was likewise dominated by a few large firms.[165] In these industries, we would expect degradation, rather than breach, to be the primary concern.[166] Consequently, we would expect networks to be poor regulators and networks should therefore be less prevalent in these industries than collections of bilateral or small multilateral connections, which can be governed by transaction regulation.[167] The framework discussed in this Article would also predict that these industries would be less resistant to government regulation since government regulation would be more effective than the network counterpart. Indeed, all these industries are in fact regulated by government and, at least in the rail industry, scholars

163. *See* Bernstein, *Opting Out*, *supra* note 30 (diamond industry); Bernstein, *supra* note 39 (cotton industry); Snyder, *supra* note 96 (internet auction websites).

164. *See* Snyder, *supra* note 96.

165. The nineteenth-century rail industry is examined, rather than the contemporary one, because regulation, which was significantly increased in the late nineteenth century and early twentieth century, affects the industry structure. The industry structure observed in a regulated industry may have more to do with a regulator's presence and preferences than with private ordering.

166. *See, e.g.*, Cremer, Rey & Tirole, *supra* note 74 (regarding degradation concerns in the internet backbone industry).

167. For a discussion of the circumstances in which transaction regulation is preferable to network regulation in the context of the natural gas industry, see Thomas P. Lyon & Steven C. Hackett, *Bottlenecks and Governance Structures: Open Access and Long-term Contracting in Natural Gas*, 9 J.L. ECON. & ORG. 380, 384–85 (1993).

indicate that government regulation was actually welcomed by the railroad companies.[168]

## V. CONCLUSION

The vast majority of private legal systems examined by the private-ordering literature are networks—institutions that facilitate network effects. This is no accident; network effects are powerful norm-enforcing tools. This Article examines the implications of network effects on private ordering. First, it identifies norm-enforcement mechanisms that take advantage of network effects and that are therefore used by networks to regulate. Second, it identifies a type of norm violation strategy called degradation that has yet to be explored by the private-ordering literature and that is facilitated by network effects. Third, it determines the market structure characteristics that are conducive to the efficient operation of the enforcement mechanisms, as well as the market structure characteristics that are conducive to degradation. Combining these together reveals the market structure most favorable to the regulatory abilities of networks. Primarily, these market characteristics are a high level of network effects and low concentration in the market in which the network members operate. Unsurprisingly, these are the same prevailing market characteristics in many (if not most) PLSs described in the private-ordering literature.

Networks employ four mechanisms to decrease opportunism: an information mechanism (collection and dissemination of information on the credibility of firms in order to facilitate independent decisions on the feasibility of transacting), an exclusion mechanism (depriving a member of access to the network), a control mechanism (centralized control of transacting facilities and other members' assets), and a switching mechanism (efficient replacement of failed transactions with alternative ones).

Network effects do not only assist in enforcing norms. They also induce a special type of norm violation, called degradation. Degradation is a predatory act that weakens the network, which harms smaller firms more than larger ones, thereby giving larger firms an advantage over

168. *See* GABRIEL KOLKO, RAILROADS AND REGULATION 1877–1916, at 3 (1965) ("Indeed, the railroads, not the farmers and shippers, were the most important single advocates of federal regulation from 1877 to 1916. Even when they frequently disagreed with the details of specific legislation, they always supported the principle of federal regulation as such."); SUSAN PERVIANT LEE & PETER PASSELL, A NEW ECONOMIC VIEW OF AMERICAN HISTORY 324–25 (1979); PAUL MACAVOY, THE ECONOMIC EFFECTS OF REGULATION (1965).

smaller competitors. Market structure and the number and relative size of network members affect the likelihood that a network will suffer from degradation. Markets containing a few large firms with a high variance in their individual vulnerabilities are particularly susceptible to degradation. When degradation is a feasible strategy for a network member, it is difficult for a regulator to deter it. Both private and public regulators have problems distinguishing harmful degradation from efficient reduction in network connectivity. Private regulators, including networks, are also hindered in their ability to punish degrading parties because their enforcement mechanisms tend to be least effective in conditions that are most conducive to degradation. Thus, parties often turn to the public legal system to remedy degradation.