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Is Harm Ever Irreparable?

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I.

Rector Magnificus, Beadle, Deans of the Schools, Professors, ladies and gentlemen:

It is my great honor to be named the first holder of the Ronald Coase Professorship in Law and Economics. I hope that the holders of this professorship will advance knowledge on the interaction between firms, markets, and property rights.

The scholarship of Ronald Coase strongly influenced my decision to combine the study of economics with the study of law. I learned of the Coase Theorem in 1975,[1] when I took a course in industrial organization. The same year, I read *The Nature of the Firm*[2] and Coase's precursor to *The Problem of Social Cost*—namely, his article, *The Federal Communications Commission*, which applied his emerging transactions-cost framework of property rights to the allocation of radio spectrum.[3]

In 1975, I also became exposed to antitrust law and to empirical economics. I became a research assistant to a fellow at the Hoover Institution of Stanford University and worked with him for the next five years on an econometric study of the deterrent effect of antitrust enforcement. During that

* Chairman, Criterion Economics, Washington, D.C. Email: jgsidak@criterioneconomics.com. This essay was my Inaugural Address for the Ronald Coase Professorship of Law and Economics at the Tilburg Law and Economics Center at Tilburg University, delivered in The Netherlands on September 16, 2011. I have not revised this essay since its presentation in 2011. However, several subsequent articles of mine expanded on themes that I introduced in 2011, most notably J. Gregory Sidak, *The Meaning of FRAND, Part I: Royalties*, 9 J. COMPETITION L. & ECON. 931 (2013); J. Gregory Sidak, *The Meaning of FRAND, Part II: Injunctions*, 11 J. COMPETITION L. & ECON. 201 (2015); J. Gregory Sidak, *Bargaining Power and Patent Damages*, 19 STAN. TECH. L. REV. 1 (2015); J. Gregory Sidak, *Irreparable Harm from Patent Infringement*, 2 CRITERION J. ON INNOVATION 1 (2017).

1 Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

2 Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA (N.S.) 386 (1937).

3 Ronald H. Coase, *The Federal Communications Commission*, 2 J.L. & ECON. 1 (1959).

time, the early giants in law and economics at the University of Chicago visited Hoover regularly. They included Ronald Coase, as well as two other future Nobel laureates, George Stigler and Gary Becker. As a student, I had the opportunity to meet all of them and hear their discussions in seminars. In this respect, my experiences at Hoover immeasurably enriched my formal education in the Stanford economics department.

These experiences occurred thirty years ago or more. Yet, distinct threads bearing a Coasean influence connect those experiences to my subsequent research and the ideas that I wish to discuss with you today. For example, my law review note in the *Stanford Law Review* in 1981 was an economic analysis of antitrust damages. After writing for many years thereafter on substantive rules in antitrust, regulation, and even the separation of powers in American constitutional law, I have come full circle. In this lecture, I return to fundamental questions about the law and economics of remedies.

Oliver Wendell Holmes famously wrote that "the duty to keep a contract at common law means a prediction that you must pay damages if you do not keep it—and nothing else."[4] I start from this Holmesian premise that one cannot truly understand the boundaries of a substantive legal right without defining the remedy for its deprivation. In this lecture, I wish to address the remedies available to an injured party who seeks redress for what he alleges is an ongoing injury arising from the unauthorized use of his property by another. Broadly speaking, that injured party is entitled to damages or an injunction. One requirement for receiving either a preliminary injunction or a permanent injunction is a showing of irreparable harm. The question I wish to pose is this: In the context of commercial business disputes, is harm ever irreparable?

II.

Before proceeding, a few words about exchange are necessary. We know that the voluntary exchange inherent in market transactions enhances social welfare because it makes both buyer and seller better off. Unless both the buyer and the seller agree to terms, the transaction will not occur. If the voluntary exchange does not impose external costs on third parties, then it necessarily increases social welfare.

Virtually all of microeconomic theory rests on the assumption that parties engage in voluntary exchange. In contrast, I have never seen a discussion of involuntary exchange in a microeconomics textbook. Nonetheless, in the law, we observe various doctrines to address several distinct forms of involuntary exchange.

[4] Oliver Wendell Holmes, Jr., *The Path of the Law*, 10 Harv. L. Rev. 457, 462 (1897).

One category of involuntary exchange occurs between the government and a private party. In these transactions, a diffuse citizenry is the intended beneficiary. Examples are eminent domain, taxation, conscription, and opportunistic use of rate regulation of public utilities. In each case, one can find an externality justification for government imposition of an involuntary transaction on private parties. It may be the need to produce a public good, such as a highway, through eminent domain. Or perhaps it is the need to provide national defense through conscription or to fund more generally the production of national defense and other public goods through taxation. Or it may be the need to abate an externality, such as air pollution, through land-use restrictions. Several provisions of the U.S. Constitution regulate involuntary transactions, either generically or specifically. The most obvious provision is the Takings Clause of the Fifth Amendment, which requires the government to pay just compensation for takings of private property for public purpose.[5]

A second category of involuntary exchange encompasses transactions between private parties and the government that specify other private parties (rather than a diffuse citizenry) as the immediate third-party beneficiary. Examples are compulsory licensing of copyrighted works; mandatory unbundling of telecommunications networks; and doctrines of forced sharing in antitrust law, including the duty to deal and the essential facilities doctrine. Curiously, notwithstanding the Takings Clause, this category of involuntary exchange is not subject to any meaningful constraint under current judicial interpretation of the U.S. Constitution.[6]

A third category of involuntary exchange concerns transactions strictly between private parties. Through the law of crimes and the law of torts, Anglo-American common law has provided a mechanism to redress the consequences of involuntary exchange. The crime of robbery and the tort of conversion are after-the-fact attempts to rectify a transaction that arose from involuntary exchange—for example, because of the use or threat of violence, or because of the use of deception or unauthorized access to another's property. Similar rights to exclude exist by statute under patent law.

III.

American courts regularly evaluate damages in contexts involving involuntary exchange by reference to the consideration that would be paid in a hypothetical, voluntary transaction that would have occurred in a counterfactual state of the world. The jurisprudence regarding governmental takings provides one example of an articulation of this principle. In 1949, in the *Kimball Laundry*

[5] U.S. Const. amend. V.

[6] *See, e.g.*, Verizon Commc'ns Inc. v. FCC, 535 U.S. 467, 523–28 (2002).

case, Justice Felix Frankfurter expressed the principle for the U.S. Supreme Court as follows:

> [S]ince a transfer brought about by eminent domain is not a voluntary exchange, this amount can be determined only by a guess, as well informed as possible, as to what the equivalent would probably have been had a voluntary exchange taken place. If exchanges of similar property have been frequent, the inference is strong that the equivalent arrived at by the haggling of the market would probably have been offered and accepted, and it is thus that the "market price" becomes so important a standard of reference.[7]

To measure the just compensation due to the property owner, courts posit a counterfactual transaction by which the property owner voluntarily conveys to the government the property rights subject to confiscation. The measure of compensation in this counterfactual transaction is the property's objective, fair market value.

Some kinds of involuntary exchange, however, involve either thinly traded markets or highly differentiated kinds of property. In these cases, a market price may not be observable. Consequently, the hypothetical, voluntary transaction among adversaries becomes a necessary heuristic for the court to use to determine damages. Such is the case in American patent-infringement disputes. In the *Georgia-Pacific* case,[8] the trial court considered the royalty owed to the patent holder to compensate for the defendant's patent infringement. The court identified fifteen factors relevant to a reasonable royalty. In both theory and practice, the most informative factor is a counterfactual analysis of the price that would emerge from a hypothetical, voluntary transaction. The court described the analysis in these words:

> The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee—who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention—would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license.[9]

Because patent infringement is one of the most active areas of litigation today, I will use patent-infringement cases to give specificity to my discussion

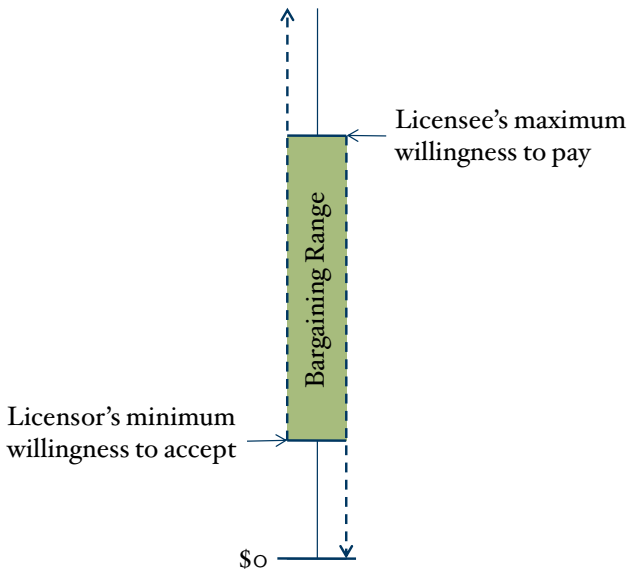
[7] Kimball Laundry Co. v. United States, 338 U.S. 1, 6 (1949).
[8] Georgia-Pacific Corp. v. U.S. Plywood Corp., 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970).
[9] *Id.*

in the remainder of my lecture. However, the conceptual framework applies to other areas of litigation involving involuntary exchange between private parties, such as antitrust cases involving forced-sharing or margin-squeeze.

IV.

An economic approach to analyzing the hypothetical negotiation is to determine the bounds of the Edgeworth Box, which are the minimum royalty that the patent holder would accept (while still being better off than without issuing a license) and the maximum royalty the licensee would be willing to pay (while still being better off than without purchasing the license). Figure 1 depicts the bargaining range in a hypothetical, voluntary negotiation. Because a successful voluntary transaction necessarily makes both parties better off, a negotiated royalty necessarily must fall between these upper and lower bounds, which define the bargaining range. U.S. courts use this hypothetical-negotiation framework for estimating reasonable-royalty damages in patent-infringement disputes.[10]

Figure 1. Bargaining Range for a Hypothetical, Voluntarily Negotiated Licensing Rate



[10] *See, e.g.*, Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1325 (Fed. Cir. 2009).

The maximum lump-sum royalty that the licensee would be willing to pay equals the incremental profits that it would expect to earn by licensing the intellectual property rather than using the next-best noninfringing substitute. An important consideration is whether there exist any noninfringing substitute inputs, or "design-arounds," and what the costs of implementing and using those design-arounds are in relation to using the patented technology.

The minimum royalty that the patent holder would be willing to accept to grant a license is a function of the losses that it would sustain by licensing rather than not licensing the patent. If the licensor and licensee directly compete, then licensing its patent will cause the licensor to incur lost sales or price erosion (or both), which would lower the licensor's profits. Consequently, the royalty must compensate the licensor for that forgone profit associated with licensing its patent to a competitor. More generally, the licensor's willingness to accept depends on its *full* opportunity cost of licensing the patent. That principle is merely an application of Armen Alchian's classic definition of cost: "In economics, the cost of an event is the highest-valued opportunity necessarily forsaken."[11] The highest net benefit of all opportunities forgone is the opportunity cost. For example, even if the holder of a patent covering a semiconductor technology does not currently compete with the infringer, the patent holder might nonetheless be forced to forgo an exclusive license with Apple. Thus, in the hypothetical negotiation with the infringer, the patent holder would demand a royalty that would compensate it for the forgone profits that its most profitable, forgone licensing opportunity would have generated.

In principle, the Edgeworth Box in a hypothetical, voluntary licensing negotiation can be empty or negative. In the case of a negative bargaining range, the patent holder's opportunity cost of licensing its patent exceeds the would-be licensee's maximum willingness to pay. Figure 2 illustrates a negative bargaining range.

[11] Armen A. Alchian, *Cost*, *in* 3 International Encyclopedia of the Social Sciences 404, 404 (David L. Sills ed., MacMillan Co. & Free Press 1968).

Figure 2. Negative Bargaining Range in a Hypothetical, Voluntary Negotiation

When the bargaining range is negative, the licensee could not pay the royalty that the patent holder demands and still be profitable. Conversely, the patent holder could not profitably accept the licensee's highest offer. Consequently, the patent holder and the would-be infringer would not have voluntarily agreed to a royalty.

Competition authorities sometimes misdiagnose this outcome as evidence of market failure or an abuse of market power. It is neither. It simply reflects that the licensor may more profitably exploit its patent through some other use than by licensing it to the would-be licensee at a price equal to the would-be licensee's maximum willingness to pay.

V.

Given the common use by courts of the hypothetical, voluntary transaction to measure damages for an involuntary exchange such as patent infringement, when would a court ever need to grant *injunctive* relief to remedy the invasion of the plaintiff's property right? Specifically, why might a court find that continuing harm is irreparable and grant the property owner an injunction, assuming that the court found that the other elements required for an injunction had been established? I have several observations about using economics to inform the legal meaning of "irreparable" in this context.

From an economic perspective, there are at least three quite different interpretations of irreparable harm. First, harm is irreparable if one cannot confidently measure it. Second, harm is irreparable to the extent that it exceeds the value of the infringer's assets. Third, harm is irreparable to the extent that it generates deadweight loss in economic efficiency, by which I mean either allocative (or static) efficiency or dynamic efficiency. Again, to make matters concrete, I will discuss these three alternative interpretations of irreparable harm in the context of patent-infringement litigation.

Consider, first, the interpretation that harm is irreparable if one cannot confidently measure it. In practice, courts typically interpret irreparable harm as injury that is difficult to quantify and monetize. For example, in *z4 Technologies, Inc. v. Microsoft Corp.*, a patent-infringement decision in 2006, the patent holder, z4, argued that it would suffer irreparable harm absent a permanent injunction because, as the court summarized the argument, "there is no way to calculate the economic success z4 might have enjoyed but for Microsoft's infringement."[12] Examples of patent-infringement injuries that the court characterized as "often incalculable and irreparable" were "lost profits, the loss of brand name recognition or the loss of market share."[13]

It is hard to swallow that empirical economic methods are so incapable of measuring the past, continuing, and future harm from the destruction of a business or an individual product line or a brand name. In recent decades, scholars and practitioners have made substantial advances in empirical and econometric methods as the cost of computing has plummeted, as statistical software has become user-friendly, and as sources of public and proprietary data have proliferated. The use of statisticians and economic experts in the damage phase of civil litigation has increased dramatically—a fact reflected in the U.S. Federal Judicial Center's publication of its *Reference Manual on Scientific Evidence* more than a decade ago.[14] Furthermore, the federal courts' increasing standard of scientific rigor for the admissibility of expert economic testimony on damages under Rule 702 of the Federal Rules of Evidence implies a belief by the federal courts that sufficient empirical methods now exist to measure damages reliably, with scientific rigor.

Additionally, the federal courts understand that the calculation of damages "is not an exact science."[15] Although the estimation of damages cannot be speculative, it "need not be proven with unerring precision."[16]

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[12] 434 F. Supp. 2d 437, 440 (E.D. Tex. 2006).

[13] *Id.*

[14] *See, e.g.*, Stephen Breyer, *Introduction*, *in* Federal Judicial Center, Reference Manual on Scientific Evidence 1 (2d ed. 2000); Daniel L. Rubinfeld, *Reference Guide on Multiple Regression*, *in* Federal Judicial Center, *supra*, at 179; Robert E. Hall & Victoria A. Lazear, *Reference Guide on Estimation of Economic Losses in Damages*, *in* Federal Judicial Center, *supra*, at 277.

[15] Del Mar Avionics, Inc. v. Quinton Instrument Co., 836 F.2d 1320, 1326 (Fed. Cir. 1987) (citing King Instrument Corp. v. Otari Corp., 767 F.2d 853, 863 (Fed. Cir. 1985)).

[16] *Id.* (citing Bio-Rad Labs., Inc. v. Nicolet Instrument Corp., 739 F.2d 604, 616 (Fed. Cir. 1984)).

Sufficient precision is present "if the evidence show[s] the extent of the damages as a matter of just and reasonable inference," even if "the result be only approximate."[17] Therefore, uncertainty and approximation in a damage estimate do not mean that the harm is immeasurable and therefore incapable of being repaired by a monetary award. In certain cases, there may be obstacles to estimating damages with sufficient confidence, which would render the damages immeasurable. However, as I explained above, it is not plausible today that in sophisticated commercial litigation such obstacles are the rule rather than the exception.

Let me turn now to the second interpretation of irreparable harm: Harm is irreparable to the extent that it exceeds the value of the infringer's assets. In other words, the injury would be irreparable if the infringer has insufficient capital to compensate the injured party fully for its injury. In a patent-infringement case, if the damage award is so great that the infringer would go bankrupt from paying damages, the court might issue a permanent injunction instead of a futile award of damages. The grant of the injunction would be recognition that monetary remedies face a corner solution. Similarly, the royalty that the infringer would need to pay to compensate the patent holder for continued, future use of the patented invention may not be sustainable, because it would force the infringer to operate at a loss. In that case, a permanent injunction may be warranted, because there is no possibility of a voluntary transaction.

This line of argumentation, however, is not entirely convincing. If the infringer cannot pay for the harm it has caused the patent owner, then the award of damages would force the infringer into bankruptcy and make the patent owner a creditor. In a variation on this scenario, the prospect of imminent insolvency could force an unsolicited corporate-control transaction by which the infringer comes under the ownership and control of the patent owner. That outcome would, most assuredly, internalize the costs of patent infringement. The scenario is not far-fetched in the least. It occurred recently in a trade secret case in California in which, after a billion-dollar jury verdict, the owner of the trade secret settled the case in exchange for damages, an equity interest in the corporation that had misappropriated the trade secret, and the expulsion of its CEO.

Under the third economic interpretation of irreparable harm, irreparability is the condition that results when an act of infringement destroys value. The destruction of value differs from the involuntary transfer of value from one party to another. By definition, an irreparable harm is something that cannot be repaired. In the words of economists, an irreparable harm is

[17] *Id.* (quoting Story Parchment Co. v. Paterson Parchment Paper Co., 282 U.S. 555, 563 (1931)).

a deadweight loss of economic welfare. It is a loss of either consumer surplus or producer surplus, or both.

When the legal phrase "irreparable harm" is understood in these terms, the rationale for granting injunctive relief is to stop the continuing destruction of aggregate economic welfare. The motivation for granting injunctive relief is therefore the imperative to mitigate harm. It is not disconsolation over the difficulty encountered when one attempts to measure, as accurately as one can, harm known to have occurred. The destruction of value, as opposed to the involuntary transfer of value from the injured party to the injuring party, is a question of static efficiency or dynamic efficiency, or some combination of the two. The constituencies that could incur irreparable harm from patent infringement are not only the patent holder, but also consumers. After determining the deadweight loss that each constituency would incur from the first alleged infringement until the patent's expiration, a court would balance the harms and consider the other relevant factors to decide whether to issue a preliminary or permanent injunction.

In terms of allocative efficiency, irreparable harm consists of deadweight losses that result from the marginal changes in price and output caused by the act of patent infringement. Economists call these losses the Harberger deadweight-loss triangle.[18] Typically, one observes the Harberger deadweight-loss triangle resulting from *elimination* of a competitor—for instance, through a horizontal merger.[19] The increase in price and the reduction in market output cause a deadweight loss of consumer surplus. Patent infringement presents the opposite outcome. When the infringement begins, the entrance of the infringer's competing product *suppresses* the price of the patented product.

Price erosion or displaced sales to the infringer (or both) would cause the patent holder to lose profits relative to the counterfactual world in which there was no patent infringement. However, because the patent holder's lost profits are transferred, not destroyed, the patent holder's past harm is not a deadweight loss. Therefore, without more, the patent-infringement injury in the form of actual lost profits does not support the issuance of a preliminary or permanent injunction. Moreover, the past harm has, by definition, already occurred by the initiation of the lawsuit; the grant of an injunction cannot reverse that harm.

One might justify the grant of a permanent injunction as a means to prevent the patent holder's future lost profits—lasting from the end of the lawsuit to the patent's expiration. However, those losses are also a transfer of wealth, not a destruction of wealth. During that period, the patent holder would continue to suffer lost profits from the patent infringement, and the

[18] *See* Arnold C. Harberger, *Three Basic Postulates for Applied Welfare Economics: An Interpretive Essay*, 9 J. Econ. Lit. 785 (1971).

[19] *See, e.g.*, Richard A. Posner, Antitrust Law 16 (Univ. of Chicago Press 2d ed. 2001).

infringer would continue to benefit from the wealth transfer. Although lost profits incurred in the future are more difficult to measure than past harm, they are not immeasurable. Monetizing future harm is not fundamentally different from valuing a license for use of a patented invention. That is, when a patent holder and a prospective licensee voluntarily negotiate a license, the patent holder requests a royalty based on the discounted present value of its expected forgone opportunity cost of licensing. Therefore, neither the deadweight-loss-in-allocative-efficiency argument nor the immeasurable-harm argument supports the issuance of a permanent injunction as a means to prevent future harm from patent infringement.

Consider now the relationship between dynamic efficiency and irreparable harm. In markets characterized by dynamic competition, firms compete not only on static price reductions, but also to introduce first the next generation of a new technology. Competition *for* the market can be viewed as a contest to define entirely new demand curves or to push existing demand curves outward with vastly improved combinations of price and performance.[20] Market rewards associated with obtaining a patent—which include supracompetitive profits from the lawful exercise of the right to exclude—promote investment in valuable inventions.

When viewed in dynamic terms, deadweight loss is the diminution or forfeiture of future welfare gains resulting from the delayed or aborted introduction of new goods. Dynamic efficiency refers to decisions made over time and includes efficiencies in investment and technological innovation. When successful, the introduction of new technologies and new goods and services, leads to large gains in consumer surplus. Conversely, as Jerry Hausman has shown, delays in the introduction of a new good can cause large losses in consumer surplus relative to what otherwise would have been attainable.[21]

Deadweight losses in dynamic efficiency are likely to be the most significant irreparable injuries caused by an act of patent infringement. Lost profits caused by price erosion and displaced sales to the infringer may impede the patent holder's ability to recover its sunk investment in its patented technology. Consequently, if not granted a preliminary injunction, the patent holder may reduce its investments in its patented technology and other related technologies compared with the amount that the patent holder would have invested absent infringement. The court's denial of a permanent injunction may further discourage the patent holder from investing in other valuable patents. By curtailing or aborting investments in new technologies, the patent holder would forgo producer surplus.

[20] *See* Howard A. Shelanski & J. Gregory Sidak, *Antitrust Divestiture in Network Industries*, 68 U. Chi. L. Rev. 1 (2001); J. Gregory Sidak & David J. Teece, *Dynamic Competition in Antitrust Law*, 5 J. Competition L. & Econ. 581 (2009).

[21] *See* Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, 1997 Brookings Papers on Econ. Activity: Microecon. 1, 13–24.

A court's decision not to issue a permanent injunction may also reduce the infringer's incentive to make future investments. When introducing a new good, the infringer chooses among alternative strategies of infringing an existing patent, licensing a patent, or producing its own invention. If the court does not issue a permanent injunction, the infringer may begin to rely on infringing third parties' patents as its primary source of entry. A reduction in the expected costs associated with the option to infringe would incline a firm away from licensing patents and from investing in its own innovations.

Consumers would suffer a deadweight loss of consumer surplus from the delayed or aborted introduction of new products by the patent holder, third-party producers, or the infringer. Such losses are irreparable harm, not a transfer of wealth. Furthermore, quantifying such welfare losses is much more difficult than quantifying the patent holder's lost profits from the infringer's past and continued use of its patented invention. One may measure the patent holder's and third-party producers' forgone producer surplus by estimating the expected returns on the investments that they would forgo due to the patent infringement. However, depending on how far into the future one is projecting, determination of which projects will get delayed or aborted may be speculative. If deadweight losses of dynamic efficiency from patent infringement are likely and the quantification of those losses is uncertain, then the irreparable-harm analysis favors the issuance of a permanent injunction. That legal conclusion, of course, would likely be no different from what the existing jurisprudence on injunctions would yield in these circumstances.

VI.

To summarize, economic analysis yields three insights on the meanings of irreparable harm. First, the interpretation of "irreparable" harm as immeasurable harm has diminishing plausibility. Quantitative and empirical methods are generally sufficient to estimate injury in business disputes with reasonable confidence. Second, harm can be irreparable because the infringer cannot afford to pay damages, but other vehicles exist to address that problem of undercapitalization—namely, bankruptcy law and the market for corporate control. Third, legitimate grounds remain for finding irreparable harm and issuing an injunction when the court's failure to do so would reduce consumer or producer surplus by reducing static or dynamic efficiency. In this third category, the reliable quantification of the destruction of value may be challenging when assessing dynamic inefficiency.

In contrast to the existing jurisprudence on injunctions, my three interpretations of irreparable harm would focus the objective of injunctive relief on averting the destruction of value caused by patent infringement, not the transfer of wealth from the patent holder to the infringer. The same logic

would apply more generally to any form of involuntary exchange, including compulsory licensing or the forced sharing of valuable assets with competitors under competition law.

Consider again my earlier question: when would a court ever need to grant *injunctive* relief to remedy the invasion of the plaintiff's property rights? I do not find any of my three economic interpretations of "irreparable harm" to have great explanatory power in answering this question. So I offer a new conjecture.

Although courts are comfortable with the counterfactual framework of the hypothetical, voluntary exchange, I hypothesize that they are uncomfortable with including large estimates of opportunity cost in the bargaining range of that model. Perhaps courts (and competition authorities, for that matter) do not fully understand the implications of Alchian's definition that cost in economics means opportunity cost. This unease increases if the would-be licensor's opportunity costs exceed the would-be infringer's maximum willingness to pay. (This condition is a standard fact pattern in any of the high-profile margin squeeze cases in Europe and the United States, in which the wholesale price of access to the essential input exceeds the retail price that the vertically integrated firm charges in the downstream market.)

Perhaps, too, courts care about appearances concerning their institutional competence. If no transaction occurs when the would-be licensor's opportunity costs exceed the would-be infringer's maximum willingness to pay, it may appear to outsiders to be the court's fault in setting too high an access price. Consequently, when a court recognizes that the bargaining range is negative, it may prefer to grant a permanent injunction instead of awarding the patent holder damages that exceed what the infringer would have been willing to pay in a hypothetical, voluntary negotiation.

If my conjecture is correct, it may signal an innate appreciation by courts of the Coase Theorem. If the would-be licensee does not value the would-be licensor's asset at the level of the would-be licensor's opportunity cost, the court will have no comparative advantage over a bilateral negotiation in making a transaction occur that increases social welfare. Rather than state publicly that the correct price emerging from a hypothetical, voluntary transaction would exceed the would-be licensor's willingness to pay, the court may prefer to say that it cannot measure the harm from the unauthorized use of the asset. In that case, the court would issue a permanent injunction, which would permit the parties' own post-injunction negotiations to confirm, in private, the conclusion that no gains from trade exist.

VII.

My future research as the first holder of the Ronald Coase Professorship in Law and Economics will surely continue to encompass antitrust, regulation, and intellectual property. However, as my lecture has suggested, I intend also to return to overarching questions concerning the law and economics of remedies in business disputes. By giving the courts a stronger economic foundation for determining remedies, lawyers and economists can better ensure that substantive liability rules achieve their intended purposes.

I wish to conclude by recognizing several persons, in addition to the scholars I mentioned at the beginning of my lecture, to whom I owe an intellectual debt. Here at Tilburg, of course, I want to recognize Pierre Larouche and Eric Van Damme for their commitment to bringing me into the extraordinary intellectual community that is TILEC. I also want to thank Damien Geradin, my co-editor on the *Journal of Competition Law & Economics*, for his friendship and collegiality over the many years we have collaborated.

I wish to thank my co-authors. I will not list them all, but I would like to recognize Jerry Hausman, William Baumol, Daniel Spulber, Tad Lipsky, David Teece, Robert Crandall, and Michael Block. I have learned much from working with them.

Finally, I wish to acknowledge that I have been privileged to have had remarkable mentors at different stages of my career: Professor William Baxter of Stanford, Judge Richard Posner, and Professor Paul MacAvoy of Yale. They epitomize for me the practical and skeptical scholar, who is committed to dispassionate empiricism and firmly grounded in an understanding of how his research can improve real-world outcomes in law, business, and government.

These attributes I also associate with the distinguished scholar for whom Tilburg University has named the professorship that I am honored to accept with these words:

Ik heb gezegd.