Economic Determinations in "Frand Rate"-Setting: A Guide for the Perplexed

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ECONOMIC DETERMINATIONS IN "FRAND RATE"-SETTING:

A GUIDE FOR THE PERPLEXED

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ABSTRACT

Owners of standard-essential patents commit to be prepared to license their technology on "fair, reasonable and non-discriminatory" terms and conditions. When negotiations over such terms break down, arbitrators and courts may be tasked with determining them. Such determinations face unusual obstacles, such as the frequent inapplicability of patent damages law to pricing large, standardized patent portfolios. The absence of good legal guidance is compounded by an economic narrative – the "standard FRAND paradigm" – which systematically misstates the circumstances, objectives and requirements of a proper FRAND determination, systematically favoring implementers of the standard. I contrast this static paradigm with the proper, economically consistent, dynamic paradigm. I then explain why a "FRAND rate determination" is usually difficult – starting with the threshold error of confining the determination to a "FRAND rate." I also identify related economic errors that pervade both expert economic testimony and legal

characterizations of the evidence in a typical proceeding. Because of the non-discrimination requirement, the consequences of such errors can persist indefinitely in later proceedings. In addition to highlighting these errors for prospective fact-finders, I close with a test for the legitimacy of a proposed FRAND determination.

I.   INTRODUCTION

When patent rights are transacted, most are priced in voluntary, private agreements covering large patent portfolios. While the parties to such transactions necessarily must agree on an aggregate price, they need not, and generally do not, agree on fundamental determinants of that price, such as how many units will be licensed, or whether the licensed patent rights are actually used in the licensed units, or indeed are valid at all. The terms, and often the existence, of such portfolio-wide transactions are usually confidential.

When patent rights are exchanged involuntarily – through infringement – individual patents are asserted in adversarial proceedings, typically a patent infringement trial. If the patent holder can prove that the asserted patents are valid and infringed, the patents are then "priced" in the form of a compensatory damages award. Being public, such trials and pricing of individual patent rights are nearly the exclusive source of "patent damages law."[1]

In short, the pricing of most patents occurs in large, uncertain, voluntary, and private contracts, but the law that governs that pricing evolves from individual, certain, adversarial, and public proceedings.

With the standardization of complex technologies comprising hundreds of inventions, and the need for firms to exchange the rights to large numbers of standard-essential patents (SEPs) on "fair, reasonable and non-discriminatory" (FRAND) terms, demand has grown for a heretofore unusual hybrid: the pricing of patents in large, uncertain, adversarial, private contracts.[2] Most commonly, the vehicle for devising such contracts is commercial arbitration.[3]

In such arbitrations, arbitrators are tasked with determining "fair" terms for a large, uncertain patent portfolio. But the damages

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1. *See e.g.,* JOHN SKENYON, CHRISTOPHER MARCHESE, & JOHN LAND, PATENT DAMAGES LAW AND PRACTICE (2017).

2. *See* Mark A. Lemley & Carl Shapiro, *A Simple Approach to Setting Reasonable Royalties for Standard-Essential Patents*, 28 BERKELEY TECH. L. J. 1135, 1135 (2013) (arbitration of FRAND terms and conditions is only advisable).

3. *Id.*

law on which they may rely they rely upon is based on individual, certain patents., the objective of that law being damages. In other words, the goal here is offer damages that adequately compensate the payee, as opposed to focusing on notions of fairness and equity, "adequate to compensate" the patentee – not "fairness."

In advocating their respective positions in such an arbitration, the patent holder and the licensee generally proffer testimony from economic experts, as they do in the damages phase of a patent infringement trial. But economists, for whom the "compensation" sought at trial is a familiar and well-defined standard, have no special expertise in determining "fairness," which is the arbitrator's objective.[4] Given that it is hard for economists to price large numbers of patents, pricing them "fairly" invites speculation and expands the scope for error, not to mention mischief.

Unsurprisingly, the disconnections between the arbitrators' task and the applicable law, and between the desired and proffered expert testimony, may lead to confused, uncertain, unreliable and unjustifiable arbitration awards.

So far, so bad: hard cases make bad law, but at least in the arbitration context they usually only make bad "private" law, because arbitration awards are generally confidential and unreviewable.[5]

Unfortunately, bad arbitration awards do not remain hidden in the FRAND context, because (under the "ND" portion of FRAND), the patent holder undertakes not to discriminate among its licensees. Thus, a bad arbitration award lives on, to be examined again and again in subsequent arbitrations involving *either* of the parties, who have obvious incentives to emphasize or minimize the significance of the award in future proceedings. In such proceedings, future arbitrators must weigh not only the competing claims before them,

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4. Under the standard economic theory of "comparative statics," economists compare an agent's economic welfare in two or more states of the world. When an agent experiences an inferior state (for example, the agent has been harmed), but is entitled by law to a superior state, the difference in welfare between the two states measures the agent's compensation. Normative "fairness" is not a consideration in determining such objective compensation. *See, e.g.*, HAL R. VARIAN, INTERMEDIATE MICROECONOMICS: A MODERN APPROACH 251-69 (Jack Repcheck ed., 8th ed. 2010).

5. *See, e.g.*, Sharon E. Schulte, *Good Policy or Judicial Abdication: When Courts Uphold Arbitral Awards Which Are in Excess of the Arbitrator's Jurisdiction – Hall v. Superior Court*, 1994 J. DISP. RESOL. (1994) (discussing the general rule that an arbitrator's decision is, with limited exceptions, unreviewable on its merits).

but also how to square a "bad" prior decision with their own obligation, on behalf of the parties appearing before them, not to discriminate.

The possibility of inconsistent, and persistent, arbitration awards with no prospect for "appellate" review and reconciliation suggests a systemic failure, which ultimately requires a systemic solution. As desirable as that might be, the present paper's objectives are more modest. I provide a "guide to the perplexed" for arbitrators who find themselves in a FRAND proceeding. As an economist, I focus on the economics of this determination, including the proper scope of economic testimony, some of the errors that economic witnesses commonly make, and how non-economists can identify and probe such errors, to avoid their contamination of the final award. As I have explained, the fact of such errors poses difficult legal problems for arbitrators faced with inconsistent past results. Thus, I also suggest ways in which future arbitrators can anticipate and attempt to harmonize past inconsistencies. These suggestions in turn point the way towards better systemic solutions, which will likely mean changes in the law governing the pricing of standard-essential patents. Naturally, those changes will ultimately be the province of lawyers, not economists.

The remainder of the paper is organized as follows. In Section II, I briefly review standard-essential patents and the FRAND regime that typically governs them. I also contrast the "standard FRAND paradigm" with a robust and balanced restatement of the policy objectives underlying the FRAND regime. In Section III I explain why FRAND determinations are intrinsically difficult, given the available data. In Section IV I also identify several common types of errors in economic testimony. Section V explores some of the spillover effects of such errors. Section VI concludes with some suggestions.

II. STANDARD-ESSENTIAL PATENTS AND FRAND LICENSING

A.   Standards and Standard-Setting Organizations

Traditionally, firms develop technology specific to their own products. Often, there is more than one way to skin a cat, so competing firms are able to create functional substitutes using their own proprietary apparatus and methods. Sometimes, firms develop

technology that they license out to others, either to competitors or to firms selling in other markets.

Again, traditionally, there is no reason for one company's product to inter-operate with another's; no one expects to mount a Chevrolet brake on a Ford. But in some industries – such as networks, which require communications among devices – it is valuable to consumers if their products interoperate.[6] Interoperability means that an Apple iPhone can communicate with a Samsung cellular base station, even though Apple and Samsung compete in the handset market.[7] Were that not the case, handset manufacturers would have to sell base stations as well, and consumers of each handset brand could only communicate with others who had purchased the same brand. The resulting proprietary networks are inefficiently small. With interoperability, there is need only for a single network. Firms then compete based on (differentiated) handset features, not on the (common) communications interface.

Standard-setting organizations ("SSOs") and standard development organizations ("SDOs") direct the development and selection of inventions into technical standards.[8] For those standards in which the choice of technology is not arbitrary – the vast majority – committees of technical experts select among proposed technical contributions to pick the "best" overall combination. Unsurprisingly, when firms propose recent technology to a technical committee, that technology may be the subject of a patent or pending patent application. There is therefore an intimate linkage between the

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6. Standards also exist when it is necessary or efficient to ensure minimum quality levels, or when other types of coordination increase public welfare or safety. Some standards, such as driving on the right-hand side of the road, or "green light means go," are mostly or entirely arbitrary; others have desirable properties relative to alternatives.

7. National Communications System Technology & Standards Division, *Interoperability*, *in* Telecommunications: Glossary of Telecommunication Terms I-15 (1996) (defining "interoperability" as "[t]he condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users.").

8. According to the Federal Trade Commission, under the Standards Development Organization Act of 2004, "… the antitrust rule of reason applies to SDOs while they are engaged in standards development activities." *See Standards Development Organization Act of 2004*, https://www.ftc.gov/enforcement/statutes/standards-development-organization-act-2004 [https://perma.cc/3HXX-GMFF]; *see also* 15 U.S.C. § 4301 (2004).

selection of the "best" technology for standardization, and patent, (and/or other intellectual property,) rights.[9]

Critically, the selection of technical contributions into a standard is *not* the result of economic competition. In economic competition, sellers offer products or services, each having a combination of features, one of which is its price. Buyers select from among these offers the offer that best suits them, or that "maximizes their utility." For some buyers, the "best" offer is also the cheapest offer; for others, the "best" offer is the highest-quality product; for still others, there exists a tradeoff among price and features that leads them to an intermediate-quality product, at an intermediate price.[10] The car market provides a familiar example. The resulting market "equilibrium" is one in which the market "clears," meaning that the number of cars offered for sale equals the number of cars purchased, at the equilibrium price(s).[11]

In contrast, within an SDO, selection of technical contributions generally occurs *without* the use or knowledge of the price of the contributed technology, for several reasons. First, most SDO rules forbid the discussion of commercial terms or legal matters when evaluating technical contributions. ,[12] They do this advisedly, as those SDO members who constitute technical standards bodies *upstream* are typically also horizontal competitors *downstream*, in the

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9. *See generally* Mark Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CALIF. L. REV. 1889 (2002).

10*. See, e.g.*, Varian, *supra* note 4.

11. *See generally* Steven Berry, James Levinsohn and Ariel Pakes, *Automobile Prices in Market Equilibrium*, 63 ECONOMETRICA 841 (1995).

12*. See ETSI Guide on Intellectual Property Rights (IPRS),* EUR. TELECOMM. STANDARDS INS., http://www.etsi.org/images/files/IPR/etsi-guide-on-ipr.pdf [https://perma.cc/ S2PG-BZ29] (last visited January 24, 2018) ("Specific licensing terms and negotiations are commercial issues between the companies and shall not be addressed within ETSI. Technical Bodies are not the appropriate place to discuss IPR Issues. Technical Bodies do not have the competence to deal with commercial issues. Members attending ETSI Technical Bodies are often technical experts who do not have legal or business responsibilities with regard to licensing issues. Discussion on licensing issues among competitors in a standards making process can significantly complicate, delay or derail this process.").

Here, as elsewhere in this paper, I illustrate the role and policies of SSOs by reference to the European Telecommunications Standards Institute ("ETSI"), whose policy regarding intellectual property rights governs the development of cellular telecommunications standards. In any individual arbitration, the policy of the governing SDO will of course be the point of reference for the parties and the panel.

standardized product market.[13] Conventional antitrust guidance strongly discourages any price-based decisions among horizontal competitors, whether in input or output markets.[14] Second, even if such discussions were permissible, the members of standards committees are technical personnel charged with a common technical mission, for which consideration of "the pricing of contributions" is deemed both irrelevant and inefficient.[15] Third, because patents are typically licensed in portfolios or other large groups, neither they nor the technical contributions they cover are "priced" individually. Moreover, the hypothetical pricing of individual contributions would almost surely conflict with the actual price charged when patents are transacted in large groups, because there is no agreed-upon method of adding up the "parts" to constitute the "whole." At the very least, such comparisons would multiply the potential for disputes, and would expose the terms of confidential actual agreements.[16] Finally, contributions to a technical standard are typically made after a patent application has been filed (to preserve the invention's public novelty), but before the patent has issued (typically several years later), during which time the patent's actual claims are subject to review, challenge and potential rejection, leaving them in flux.[17] Thus, it is unclear what rights, exactly, are to be "priced" at the point the contribution is made.

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13. *Id.*

14. *See An Antitrust Primer for Federal Law Enforcement Personnel*, at 4, 6. U.S. DEP'T OF JUST. (Apr. 2005), https://www.justice.gov/atr/file/761666/download ("Price fixing is any agreement among competitors which affects the ultimate price or terms of sale for a product or service. It is not necessary, however, that the conspirators agree to charge exactly the same price for a given item…. Price fixing, bid rigging, and market allocation are generally prosecuted criminally because they have been found to be unambiguously harmful, that is, per se illegal").

15. *See* ETSI Guide on Intellectual Property Rights (IPRS), *supra* note 12.

16. The only way to compare the hypothetical price of an individual contribution with the actual price of a patent portfolio is to expose the portfolio agreement to independent review. In general, there is no mechanism within an SDO that requires or protects the disclosure of the confidential commercial information of SDO members. *See* U.S. Department of Justice, *supra* note 14.

17. According to the United States Patent and Trademark Office, the average interval from the time of patent application to the time of issuance, during which a patent's claims are examined and allowed or rejected, was about 33-40 months in 2011, approximately the date that ETSI's Long-term Evolution (LTE) standard was initially implemented in the United States. *See Pendency of Patent Applications (2 visuals)*, U.S. PATENT AND TRADEMARK OFFICE, https://developer.uspto.gov/visualization/pendency-patent-applications-2-visuals [https://perma.cc/84TZ-GG6L] (last visited May 22, 2018).

Once the set of technical contributions that together constitute the standard is set, standard-compliant devices must adhere to the standardized specification. To the extent that adherence to the standard means practicing the claims of a patent, any such patent is then considered a SEP.[18] Again typically, however, SDOs do not themselves determine whether any given patent is a "standard-essential patent." In other words, even after a member's technical contribution has been accepted and adopted into the standard, any patents associated with that contribution may nevertheless not meet the definition of a SEP.[19] The important point is that no one knows, one way or the other, whether any given patent is essential to the standard.

B.   *The Benefits and Costs of Standardization*

Standardization presents a number of potential benefits and costs. In addition to interoperability, the other principal benefit is that the SDO is able to combine the best proposals from every member, to create a common communications interface that is superior to – faster, more reliable, cheaper than – any individual firm's technology.

We can think of these two standardization benefits as "static" and "dynamic." The static benefit – one that occurs at a given point in time, using off-the-shelf technologies – is the gain from interoperability, that is, from requiring every device to work the same way. The dynamic benefit – one that occurs over time – is the benefit

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18. *See ETSI IPRP* Eur. Telecomm. Standards Ins. (Apr. 5, 2017), http://www.etsi.org/images/files/IPR/etsi-ipr-policy.pdf   [https://perma.cc/M3CU-AB2H] ("'ESSENTIAL' as applied to IPR means that it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the time of standardization, to make, sell, lease, otherwise dispose of, repair, use or operate EQUIPMENT or METHODS which comply with a STANDARD without infringing that IPR. For the avoidance of doubt in exceptional cases where a STANDARD can only be implemented by technical solutions, all of which are infringements of IPRs, all such IPRs shall be considered ESSENTIAL.").

19.   For example, suppose that an SDO member proposes technical contribution A, an invention that is also claimed by Patent 1. Suppose that the SDO adopts the substance of contribution A, which it then codifies in technical specification B. To simplify its proofs of infringement, the patentee files a "continuation" application, relying on the disclosure found in Patent 1 but using the language of B to draft new claims; these issue as another member of the same "patent family," Patent 2. Then, assuming the definition of essentiality is met, Patent 2 may be "standard-essential," but Patent 1 may not.

of inducing firms to compete to find solutions to each technical problem, then choosing the best solution.

Standardization also has potential costs. The potential cost that has captured by far the most attention from policymakers and standards implementers – and from the SSOs themselves – is the possibility of "hold-up" by the owner of a standard-essential patent. Hold-up is a form of economic opportunism, by which one party to a relationship takes advantage of the other party's investment in that relationship, by attempting to renegotiate terms after the second party has sunk its investment.

For example, suppose in the winter a homeowner solicits proposals from contractors to build a pool in the summer, on a time-and-materials basis. The winning contractor takes a construction deposit; the losers fill their summer schedules with other work. Halfway through the job, the winning contractor demands an additional "completion fee" to finish. With her construction at risk, and unable to find another installer, the homeowner agrees to the demand. The homeowner has been held "held up" by the contractor.

Of course, skilled attorneys anticipate such problems and draft contracts to avoid them, and/or to make such opportunism unprofitable. But when the parties cannot contract over the investment (in this case, the homeowner's selection of one installer to the (permanent) exclusion of others), and when the price or another contractual parameter cannot be specified in advance, the potential for hold-up exists.[20]

From a legal perspective, such opportunism is *unfair*. From an economic perspective, the main problem with opportunism is that, being foreseeable, it causes parties not to transact at all. In other words, parties fail to invest in otherwise profitable relationships, because they fear the counter-party will take advantage of them. Such foregone transactions are economically *inefficient*.

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20. More formally, hold-up occurs in the presence of two factors:
  1. Parties to a transaction make noncontractible, relationship-specific investments, before the transaction takes place.
  2. Some parameter of the transaction (price, quality, quantity, date) cannot be specified with certainty.
  See William P. Rogerson, *Contractual Solutions to the Hold-Up Problem*, 59 REV. ECON. STUD. 777, 777 (1992).

In the context of standard-essential patents, hold-up could arise under the following facts:

> (a) the owner of an SEP makes a technical contribution, any implementation of which practices the claims of the patent;

> (b) the SDO selects the contribution into the standard, without specifying a price for the SEP;

> (c) implementers invest in the implementation of the claims of the SEP, as part of their implementation of the standard;

> (d) the patent owner seeks "extra" payment for the use of the SEP, exploiting the implementers' prior implementation investment and lack of alternatives.

Since such conduct by SEP owners is foreseeable, implementers might refuse to invest in implementing the standard, thus depriving all concerned of the benefits of standardization.

To pre-empt this undesirable outcome, SSOs routinely require that those who contribute to a technical standard must promise to forego such opportunism. This promise takes the form of a "FRAND undertaking," by which the holder of an SEP promises to be prepared to grant a license on "fair, reasonable and non-discriminatory" terms.[21] Unlike most other SSOs, ETSI further requires that contributors to technical standards disclose the identity of related patent rights that "may be essential" to the standard.[22] While sometimes called "declared-essential patents," patents identified in this manner only have the (subjectively believed) *potential* to be essential, at the time of the declaration.[23]

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21. The ETSI undertaking is exemplary:

> To the extent that the IPR(s) disclosed in the attached IPR Information Statement Annex are or become, and remain ESSENTIAL in respect of the ETSI Work Item, STANDARD and/or TECHNICAL SPECIFICATION identified in the attached IPR Information Statement Annex, the Declarant and/or its AFFILIATES are (1) prepared to grant irrevocable licenses under this/these IPR(s) on terms and conditions which are in accordance with Clause 6.1 of the ETSI IPR Policy.

See ETSI Guide on Intellectual Property Rights (IPRS), supra note 12. Other SDOs omit "fair" as a requirement, though I am aware of no rate-setting decision that has turned on this distinction.

22. *See id.* at "IPR Information Statement and Licensing Declaration" ("In accordance with Clause 4.1 of the ETSI IPR Policy the Declarant and/or its AFFILIATES hereby informs ETSI that it is the Declarant's and/or its AFFILIATES' present belief that the IPR(s) disclosed in the attached IPR Information Statement Annex may be or may become ESSENTIAL…").

23. *Id.*

C.   The "Standard FRAND Paradigm"

With this background, one can efficiently characterize what may be called the "standard FRAND paradigm." This paradigm appears as a stock character in FRAND arbitrations and similar disputes. Although it is empirically unsupported, and typically has little or no relevance to the facts or expert testimony of an individual case, the "standard FRAND paradigm" forms an important part of what (some) parties deem to be fair conduct; the failure to conform to the paradigm is, so this argument goes, *per se* evidence that a patent holder has violated its FRAND undertaking.[24]

Under this paradigm, the relevant sequence of events may be described below:

Figure 1: Static Standardization
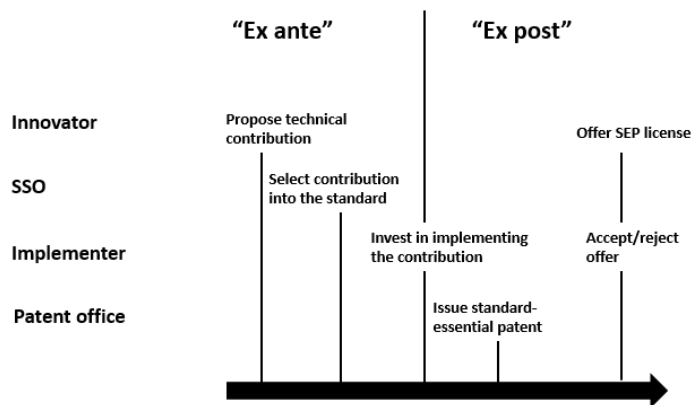
This sequence conforms to the textbook definition of a hold-up problem: following the standardization of the technology by the SDO, the implementer must invest in implementing the standardized technology – not knowing whether, or in what form, patent claims on the technology may exist, nor knowing their price. Eventually, the patent office issues a patent, crystallizing its claims; still later, the innovator/patentee offers to license the now-standard-essential patent, at a price that the implementer finds "excessive," and therefore a

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24.   *See, e.g.*, *Policy Statement on Remedies For Standards-Essential Patents Subject to Voluntary F/RAND Commitments,* U.S. DEP'T OF JUST. (Jan. 8, 2013), http://www.justice.gov/atr/public/guidelines/290994.pdf [https://perma.cc/R8VP-6WQA].

violation of the patentee's FRAND undertaking. The typical explanation for the "excess": hold-up by the patentee, who is exploiting the implementer's specific investment in the standardized technology, for which the implementer now lacks any alternative.

The patentee may respond that the offered price is the same as the actual price paid by existing licensees, as shown in actual contracts. The patentee may further point to the ETSI IPR Policy itself, which historically has favored the negotiation of such contracts.[25] But under the "standard FRAND paradigm," the prices observed in actual license agreements are themselves contaminated by the patentee's hold-up of its other licensees. They are, therefore, uniformly unreliable and ought not to be admitted as evidence. In other words, hold-up is so pervasive that one cannot even test for its existence, given the available data.

The "standard FRAND paradigm's" solution to this alleged evidentiary vacuum is to postulate a so-called "*ex ante* price" for the standardized patent. The "*ex ante* price" is the price that the patentee supposedly could have charged, at a point in time *before* implementers sink their investments into the standardized technology, as shown in Figure 1, because it is at that point that the patentee would have had to "bid" against competing alternatives for selection into the standard, thereby "locking in" implementers to the investment.[26] That bid, so the paradigm goes, is the maximum value that the patentee could have expected in a "competitive market," and reflects only the value of the technology itself – not the additional market power, and potential for opportunism, conveyed by the patent's selection into the standard.[27] The decision to value the

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25. *See, e.g.*, *Interim Report of the UMTS IPR Working Group*, EUR. TELECOMM. STANDARDS INS. (Sept. 2008), http://www.qtc.jp/3GPP/GSM/SMG_27/tdocs/P-98-0608.pdf [https://perma.cc/C799-M5RZ] ("The value of the ETSI IPR Policy as the sole vehicle for the handling of IPR issues relating to standards lies in . . . the fact that the complex commercial issues of the details of licenses and of compensation therefore, are placed where they belong, *at the center of bilateral negotiations between licensor and licensee*") (emphasis supplied).

26. Though not required as a matter of economic theory, implementers have argued, and trial courts have sometimes accepted, that the price-determination date should also precede the point in time when the SDO selects the patentee's contribution. *See, e.g.*, Ericsson, Inc. v. D-Link Systems, Inc. 733 F.3d 1201, 1234 (Fed. Cir. 2014) (providing an example of how courts have accepted the price-determination date from the point in time where the SDO selects the patentee's contribution).

27. The distinction between the "value of the technology" and the "value of the standard" has found its way into patent damages law. *See id*. at 1233.

technology "ex ante" is said to conform to common practice within patent damages law, which hypothesizes a negotiation between the patentee and licensee "on the eve of infringement."[28]

Further, when measuring the value of this hypothetical bid, the court should consider only the "incremental value" of the technology over its next-best alternative[29] that would have been available to the technical standards body – again, a widely approved approach in patent damages law.[30]

Elements of the "standard FRAND paradigm" have found their way into high-level policy statements echoed by the major US regulatory agencies.[31] And as a legal matter, a patentee's FRAND undertaking is now treated as a contract with the SDO, of which an implementer is a third-party beneficiary who has its own cause of action for breach of the FRAND contract.[32]

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28. *See* Integra Life Sciences I, Ltd. v. Merck KgaA, 331 F.3d 860, 870 (Fed. Cir. 2003) (noting that hypothetical negotiation occurs "at a time before the infringing activity began"). *Accord* Lucent Techs., Inc. v. Gateway, Inc., 580 F.3d 1301, 1324 (Fed. Cir. 2009); LaserDynamics, Inc.v. Quanta Computers, Inc., 694 F.3d 51, 75 (Fed. Cir. 2012) (holding that hypothetical negotiation takes place the date infringement began).

29. *See* Microsoft Corp. v. Motorola Inc., et al., No. C10-1823JLR, 2013 WL 2111217, at *27-28 (W.D. Wash. 2013) (holding that a comparison of the patented technology to the alternatives that the SDO could have written into the standard is a consideration in determining a RAND royalty).

30. *See* Grain Processing v. American Maize Prod. Co., 185 F.3d 1341, 1341 (Fed. Cir. 1999) ("Only by comparing the patented invention to its next-best available alternative . . . can the court discern the market value of the patent owner's exclusive right, and therefore his expected profit or reward").

31. *See, e.g., Policy Statement on Remedies For Standards-Essential Patents Subject to Voluntary F/RAND Commitments,* U.S. DEP'T OF JUST. (Jan. 8, 2013), http://www.justice.gov/atr/public/guidelines/290994.pdf   [https://perma.cc/LR3X-YEC6] [hereinafter DOJ SEP Policy].

32. As courts have found, when a holder of a standards-essential patent makes a commitment to an SDO to license such patents on F/RAND terms, it does so for the intended benefit of members of the SDO and third parties implementing the standard. These putative licensees are beneficiaries with rights to sue for breach of that commitment. *See* Microsoft Corp. v. Motorola, Inc., 864 F. Supp. 2d 1023, 1030-33 (W.D. Wash. 2012); Microsoft Corp. v. Motorola, Inc., 854 F. Supp. 2d 993, 999-1001 (W.D. Wash. 2012); Microsoft Corp. v. Motorola, Inc., 696 F.3d 872, 884 (9th Cir. 2012) ("[The] district court's conclusions that Motorola's RAND declarations to the ITU created a contract enforceable by Microsoft as a third-party beneficiary (which Motorola concedes), and that this contract governs in some way what actions Motorola may take to enforce its ITU standard-essential patents (including the patents at issue in the German suit), were not legally erroneous."); Apple, Inc. v. Motorola Mobility*, Inc., —- F. Supp. 2d —-, No. 11-cv-178bbc, 2012 WL 3289835, at *21-22 (W.D. Wis. Aug. 10, 2012); Apple, Inc. v. Motorola Mobility, Inc., No. 11-cv-178bbc, 2011 WL 7324582, at *7-11 (W.D. Wis. June 10, 2011). *See* DOJ SEP Policy, *supra* note 31, at 7.

While FRAND-based licensing policies have given rise to dozens or hundreds of voluntary licenses, some implementers insist that the entire regime that produced these licenses "does not work."[33] For example, Apple insists that using the price of a handset, such as an iPhone, to meter the value of a standard-essential patent portfolio is "inherently discriminatory,"[34] and therefore non-FRAND.[35] Similarly, Apple claims that the "best" method for determining royalties for standard-essential patents practiced by a handset is to employ the price paid for the so-called "smallest salable patent practicing unit," which Apple identifies as the handset's baseband processor chipset – a method not employed in actual industry agreements.[36] Despite having launched arguably the most successful consumer product in history, Apple even claims to have "faced excessive royalty demands, onerous contract terms and the threat of injunctions barring the sale of a revolutionary new product," "a history . . . [that] has left [the FRAND licensing] promise at least partially unfulfilled."[37] Faced with these economic headwinds, Apple has sold just 1.2 billion iPhones in 10 years, worth $738 billion.[38]

In this ostensibly fallen world, some widely cited commentators have argued that arbitration of FRAND terms and conditions is not only advisable, but should be made mandatory by the SDO.[39] Whether an SDO mandates arbitration or not, under the "standard FRAND paradigm" arbitrators face a formidable array of "settled" justifications for FRAND policies in general, and for vindicating the rights of the implementer in particular, that invariably point to a reduction in the rates to be paid for standardized technology –

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33. *See, e.g., Letter from B.J. Watrous to Telecom Regulatory Authority of India,.* (Nov. 10, 2017), http://www.trai.gov.in/sites/default/files/Apple_%20Inc_CP_PLTEM.pdf [https://perma.cc/8KLK-VNYQ] ("What does not work in practice are [average sales price]- or use-based methodologies for determining FRAND royalties").

34. *Id.*

35. *Id.*

36. *See id.*

37. *See id.*

38. Ian Morris, *Apple Has Sold 1.2 Billion iPhones Worth $738 Billion In 10 Years,* FORBES (June 29, 2017), https://www.forbes.com/sites/ianmorris/2017/06/29/apple-has-sold-1-2-billion-iphones-worth-738-billion-in-10-years/ [https://perma.cc/W4MD-LGQ3]

39. *See* Lemley & Shapiro, *supra* note 2 (arguing that arbitration of FRAND terms and conditions is not only advisable, but should be made mandatory by the SDO). *But see* Pierre Larouche, Jorge Padilla and Richard S. Taffet, *Settling FRAND Disputes: Is Mandatory Arbitration a Reasonable and Non-Discriminatory Alternative?,* 10 J. COMPETITION L. ECON. 581, 581 (2014) (coming up with an opposite holding).

regardless of how many others may have voluntarily accepted those rates in the past. The present question is whether the "standard FRAND paradigm" assists arbitrators in executing the task before them: to identify terms and conditions that are truly "fair," "reasonable" and "non-discriminatory."[40] The short answer to that question: no.

D.   The Failures of the Standard Paradigm

The simplest way to encompass the standard paradigm's errors in a single view is to consider the differences between the static gains from standardization, and its dynamic gains. In the standard paradigm, gains arise from the agreement by all participants to settle on a single, agreed-upon, existing technology. These are the gains from agreeing to drive on the same side of the (existing) road. Since the alternatives – left side or right side – already exist and are largely equivalent, it makes little or no difference which alternative becomes "the standard." And any reward to the chosen alternative is simply a windfall, since both the chosen alternative and its perfect or near-perfect substitutes came into existence exogenously, before the possibility of standardization even existed. Society gains, not from the particular alternative, but from the coordination that results from agreeing on a single alternative. In short, these are "coordination gains." Rewarding the (private) owner of the chosen alternative for the (social) decision to coordinate is not only misplaced; it is "unfair," because any such reward comes at the expense of those for whom the coordination occurs: implementers, and their customers.

But this account of technological standardization leaves unexplained where the candidate technical contributions came from – it simply assumes their existence. Such accounts of the process are "static," because they assume (and hold constant) the state of technology as it exists at the single point in time when coordination

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40. While it is still in wide circulation among competition-oriented economists, evidence for any of the constituent elements of the "standard FRAND paradigm" has been found lacking. *See e.g.* Certain 3G Mobile Headsets, Inv. No. 337-TA-613, USITC Pub. 4145 (Apr. 2015) (Remand) at 63 ("Of all the settlements and licenses that were taken under the 'threat' of an exclusion order, not one respondent has gone on to file in a district court that the agreement was outside the range of FRAND. The ITC has not seen such a case, the experts presented at the hearing have not seen such a case, and the respondents did not cite an example of such a case. With that in mind, perhaps now we can relax our guard a little.").

occurs. In contrast, by far the greater gains from standardization are "dynamic" – that is, those gains induced over time by improvements in technology. These gains arise because innovators invest in R&D, with the fruits of which they compete for selection into the standard. That selection process is fundamentally different from market-based R&D competition, because it is "winner take all": the best invention is culled from among those proposed, and is then used by all firms; the other candidates are discarded. The errors introduced when the outcomes realized under static market competition are substituted for those appropriate to a dynamic, winner-take-all regime are well-known, as I explain below.[41]

In short, for all of the supposed consensus reflected in the "standard FRAND paradigm," the trouble with the paradigm is that it contradicts standard economics. For this reason, the paradigm also cannot produce "FRAND outcomes."[42] At each step, the paradigm is incomplete, or flat wrong.

1. The Sequence of Investments

The sequence of events under dynamic standardization is shown in Figure 2. In order for the SDO to have something to standardize, contributors to the standard must first conduct R&D, to develop potential contributions. R&D is, of course, a costly investment.

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41. As I explain below, the result of such a policy is "dynamically inconsistent."

42. *See* Jonathan D. Putnam, *The "Standard FRAND* Paradigm" is Not Standard. Or FRAND (2017) (unpublished manuscript) (on file with author).

Figure 2: Dynamic Standardization
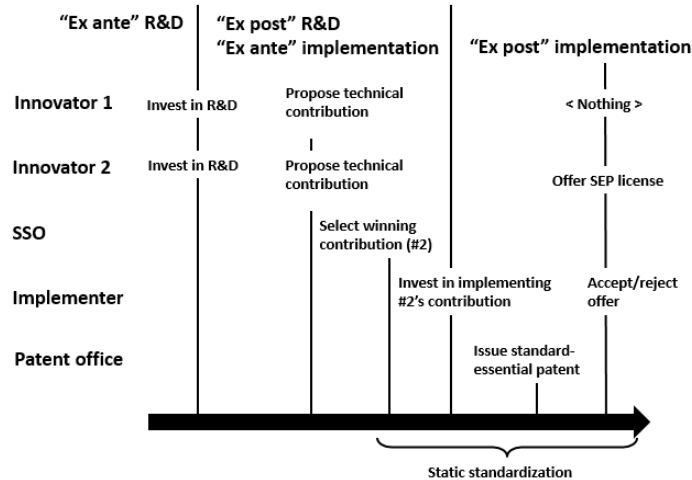
R&D conducted in anticipation of potential standardization does not arise randomly or exogenously, of course. Firms invest in R&D because the SDO – usually with the innovating firms' participation – has promulgated certain general objectives for the standardized technology. R&D conducted in anticipation of potential standardization is also, therefore, a "relationship-specific" investment, because standardization – by definition – reduces or eliminates alternative uses of technologies that are not selected into the standard, but could have competed with it. There is usually no "second SDO" or other customer to whom a losing contribution can be offered.

As with static standardization, the process of dynamic standardization proceeds with the selection of one contribution into the standard from among those proposed, followed by investments by implementers, issuance of the patent, and license negotiations, as both Figure 1 and Figure 2 show. We can therefore conceive of dynamic standardization as economists often do, as a two-period model in which innovators conduct R&D in the first period, while the SDO standardizes on the winning technology to be implemented in the second period. Figure 2 shows how the "standard" model of static standardization is embedded within the dynamic model. Thus, in this context as in many others at the intersection of intellectual property and antitrust policies, the two-period process of dynamic

standardization contains static standardization (in the second period) as a special case, when there is no need to explain where the standardized inventions came from. Of course, when standards evolve with technological change – and a principal objective of standardization is to ensure that technological change occurs as rapidly and efficiently as possible – such "special cases" are not only irrelevant, but misleading.

Thus, the first error of the standard paradigm is to ignore both the investments required to generate the candidate contributions from which the SDO will choose, and the inducements on which such investments have relied.

2. The Hold-up Problem

As we have seen, hold-up can occur when parties make non-contractible, relationship-specific investments, and when they cannot specify in advance all the terms of the contract governing their relationship.[43] By this definition, innovators *also* face hold-up: to compete for selection into the standard, they must (1) invest in R&D; but they do so (2) with no assurance of the price or other terms of their compensation, other than that such compensation is supposed to be "fair."[44]

Because *both* innovators and implementers make relationship-specific investments, and because *neither* group can specific *ex ante* the terms of the contract on which they will eventually agree, the standard-setting process inherently contains the potential for *bilateral* hold-up. As with hold-up by innovators, hold-up by implementers takes the form of exploiting the innovators' prior (R&D) investment to extract opportunistic gains from the relationship. Just as innovators can hold up implementers by demanding a price that is "too high" *ex post,* implementers can hold up innovators by demanding a price that is "too low" *ex post.* The "hold-up problem" is therefore symmetric.

When implementers hold up innovators, the situation is sometimes called "reverse hold-up" or "hold-out."[45] The "standard

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43. Rogerson, *supra* note 20.

44. *See ETSI Guide on Intellectual Property Rights (IPRS), supra* note 12 (IPR holders whether members of ETSI and their AFFILIATES or third parties, should be adequately and fairly rewarded for the use of their IPRs in the implementation of STANDARDS and TECHNICAL SPECIFICATIONS").

45. *See infra* note 42.

FRAND paradigm" erroneously omits the innovator's half of that hold-up problem.

In an adversarial arbitration – in which, by definition, the parties have failed to agree on terms and conditions for the exchange of patent rights – the arbitrators thus face two competing, conceptually symmetric narratives: the implementer can point to the failure to agree as evidence of hold-up, because the offered terms are "too high"; the innovator can point to the same failure to agree as evidence of hold-out, because the counter-offered terms are "too low." But it is fair to say that the great weight of academic commentary and "concern" expressed by antitrust regulators has fallen on the side of hold-up, with concerns about hold-out often being considered speculative and "amorphous."

In an actual arbitration, the positions of the parties may be more nuanced than the stylized representation described here. Often, each party is both an innovator and an implementer; they are exchanging rights patent rights via a cross-license. In theory, this means that each party should advocate both narratives: a high price for its own technology, and a low price for its adversary's. Of course, such advocacy is tricky, because the arguments supporting either position generally apply to both parties. In practice, however, the parties usually anticipate that, despite their countervailing claims, one party is the "net licensor," while the other is the "net licensee," with the end result of the license being some kind of "balancing payment" from the net licensee to the net licensor.[46] Under such circumstances, the net licensee's *net* interest – the lowest possible balancing payment to the net licensor – coincides with the implementer's "low price" narrative, while the net licensor's opposing interest coincides with the innovator's "high price" narrative. Thus, in an individual arbitration, each party can avoid the charge of hypocrisy by adopting the narrative most closely aligned with its interests. And because arbitrations are usually confidential, a party who appears as a net licensee in one arbitration and a net licensor in another is generally free to advocate whichever narrative best advances its immediate interests. In general, no "estoppel" attaches to such inconsistent positions.[47]

46*. See infra* Section III.A.

47*. Id.*

Arbitrators must be aware of these structural inconsistencies, which are occasioned by the likelihood that the same firm will appear as the net licensee against a "stronger" firm (*i.e.,* one having the larger claim), but a net licensor against a "weaker" firm.[48]

While the positions of innovator and implementer in a FRAND arbitration are conceptually and economically symmetric, they are not legally symmetric. Under the rules of most SDOs, the innovator commits to the SDO to be prepared to license on FRAND terms. As explained above, this commitment has been interpreted to have the force of a contract, of which the implementer is a third-party beneficiary. The failure to keep that commitment is thus interpreted as a "breach of contract." On the other hand, while an innovator may also expect "fair" compensation, implementers do not undertake to ensure "fair" compensation – or, indeed, any compensation at all – as a condition of their implementation of the standardized technology.[49] In fact, implementers need enter into no undertaking with the SDO of any kind. Thus, while "hold-up" may constitute a "breach of contract" by the innovator, "hold-out" by the implementer is not a "breach" of anything.[50]

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48. In a recent paper, I surveyed developments in FRAND-related litigation, and summarized the relative positions of the major innovators and implementers of telecom-related standard-essential patents. *See* Jonathan D. Putnam, *Latest Developments in FRAND and SEP Litigation* Intellectual Asset Management Yearbook (2016) (characterizing the bargaining positions of telecommunication firms based on their shares of sales and of industry SEPs). Based on the then-current market shares and patent holdings of these firms, Table 1 of that paper shows that certain firms (those having both significant sales and significant SEP portfolios) are more likely to appear as both "net licensors" and "net licensees," while others are more likely to appear as either a net licensor or net licensee).

49. For example, ETSI does not require a standard implementer to commit to any particular compensation for contributors to the standard as a condition of implementing its standard. *See ETSI IPR Policy, supra note* 12.

50. Some litigants have argued that, in the particular case of ETSI, French law (which governs the ETSI IPR Policy) imposes on both parties the duty to negotiate in good faith. Hold-out could then be interpreted to violate that duty. The consequences of such an alleged violation are unclear.

> Bad-faith holdout may, however, deprive an implementer of its third-party benefit under the SDO contract, and/or permit an SEP holder to seek equitable relief. In one of the few decisions to define and find holdout on the part of an implementer, an administrative law judge of the U.S. International Trade Commission determined that Microsoft's conduct met the definition of bad-faith holdout, finding Microsoft to be an "unwilling licensee" subject to an exclusion order.

> [Microsoft and its predecessor-in-interest, Nokia] argued at length th[at] [InterDigital] violated FRAND, against the testimony of their own witnesses. They

3. "Ex ante"

Because the standard paradigm misspecifies the sequence relevant of events, and ignores the implementer's half of the hold-up problem, it should be unsurprising that the standard paradigm's proposed treatment of the problem – "ex ante" valuation of the standardized technology – is as unreliable as its diagnosis.

As Figure 1 shows, under the static standardization model, the division between the "ex ante" and "ex post" period occurs prior to the implementer's investment in the standardized technology – preferably, under the standard paradigm, prior to the SDO's selection of the technology. This choice of negotiation date blunts the innovator's supposedly superior and undeserved bargaining power, by giving the SDO the freedom to select a different technology. But as Figure 2 shows, under the dynamic standardization model, this date coincides with the point in time *after* each of the innovators has sunk its investment in R&D, but *before* the SDO has committed to reward any of the innovators by selecting its innovation. Thus, if (contrary to fact) an innovator were permitted to "bid" for selection of his technology into the standard, and if the alternatives he faced were to (1) lower his bid in hopes of his technology being selected, thus receiving a reduced return on his prior R&D investment, or (2) lose the bid entirely to a lower-priced innovator and receive no return on investment at all, then strategy (1) dominates strategy (2), for all innovators. In short, the standard FRAND paradigm proposes that

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argued the offers were not FRAND for a variety of reasons, but had no evidence to support even one assertion. There is however, one course of action that can clearly demonstrate bad faith, and that is a failure to meaningfully negotiate. This was the case in *Realtek v. LSI* . . . and is the case here . . . . In failing to negotiate in a meaningful way, and refusing to take a license, [Microsoft] is currently an unwilling licensee that "is unable or refuses to take a FRAND license[.]"

. . . evidence in this case supports a finding that MMO engaged in reverse holdup or holdout. In reviewing and considering the letters written by the FTC, DOJ, and PTO, the ALJ considered the concerns that the agencies raised regarding the potential abuse of the SEP patents, and finds that no such abuse occurred in this case. There was no evidence in the case that the risks raised by the agencies occurred in this case . . . . Therefore, there is no evidence in this case, either presented by the parties, within the public interest factors of 19 USC §1337, or in the policy letters, comments or submissions from other agencies or companies that an exclusion order should not be issued.

See Certain 3G Mobile Handsets, Inv. No. 337-TA-613 USITC Pub. 4145 (Apr. 2015), (Remand).

innovations be priced as if innovators had engaged in a "race to the bottom" bidding war in which their R&D costs, being sunk, are irrelevant. The "ex ante" date advocated by implementers is, in short, the point in time of *minimum* innovator bargaining power, and *maximum* implementer bargaining power.

Under the dynamic standardization model, if one believed that proper compensation could only be calculated "ex ante," free of the potential for hold-up, then that point in time is not immediately prior to the implementer's sinking its investment in the (actually) standardized technology, but immediately prior to the innovator's sinking its investment in the (potentially) standardized technology. In other words, if the hold-up problem is bilateral and symmetric, then "ex ante" must mean "before either party has made its relationship-specific investment." As Figure 2 shows, this point in time necessarily precedes the time proposed under the standard paradigm. It also removes the unwarranted bargaining power that the standard paradigm erroneously bestows upon implementers.

The "ex ante" approach also suffers from the comparatively benign infirmity that it is impossible to implement, because in practice there are no such things as "ex ante" prices. These prices do not exist for many reasons: there is no "ex ante" market; there are no "ex ante" trades; usually, there are not even "ex ante" patents, because as Figures 1 and 2 show, the patent office has not issued the patents at the time the SDO makes its selection. Thus, in arguing for "ex ante" pricing, advocates of the standard FRAND paradigm purport to have spotted a mythical beast: no economist has ever, even in theory, calculated an "ex ante," pre-standardization price, as evidenced by the absence of any citation in the "standard FRAND paradigm" to an academic paper or treatise that supports such a calculation.

To his credit, Judge James L. Robart recognized, in *Microsoft v. Motorola*, that "ex ante" pricing lacks "real-world applicability."[51] That admission contrasts with the position advanced by Lemley and Shapiro, who argue that "the point of the hypothetical negotiation rule in patent damages is to determine what hypothetical reasonable parties might have done, had they had all the facts, including

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51.   Microsoft Corp., 696 F.3d at 898.

knowledge of non-infringing alternatives."[52] But this general restatement of patent damages law ignores the specific problem that "ex ante" prices *do not exist*, so it is impossible even to hypothesize what parties negotiating "ex ante" would do "if they had all the facts." What Lemley and Shapiro appear to have in mind is some kind of comparison of the marginal physical product of each alternative (roughly speaking, a measure of its technical superiority over the next-best alternative), which in one way or another must have been the basis of the SDO's selection decision, as an indicator of the winner's "incremental value." But even that refinement is conceptually incorrect.

4. "Incremental value"

Citing long-established patent damages law, the standard FRAND paradigm states that the standardized invention should be priced based on its "incremental value."[53] In the static standardization paradigm, the SDO considers various alternatives and selects the best, but always (at least in theory) having been able to switch to the second-best alternative. The difference in the value of the standardized product when using these two alternatives is the value of the chosen alternative, or potentially an "upper bound" on that value.[54]

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52. Lemley & Shapiro, *supra* note 2, at 1148.

53. When dealing with SEPs, there are two special apportionment issues that arise. First, the patented feature must be apportioned from all of the unpatented features reflected in the standard. Second, the patentee's royalty must be premised on the value of the patented feature, not any value added by the standard's adoption of the patented technology. *See* Ericsson, 773 F.3d at 1231 (holding that the royalty award is "based on the *incremental value that the patented invention adds to the product*, not any value added by the standardization of that technology") (emphasis added). When contemplating this value, it is not always clear what "increment" is envisioned: it could be the notional change in price of the patented product with the patented feature removed, or it could be the notional change in price of the patented product with the "next-best available non-infringing alternative" substituted in place of the patented feature.

54. The hypothetical negotiation needs to take place under conditions where the alternative specifications have been identified, so that the parties are well informed about the best potential non-infringing alternatives to the proposed standard. The key idea here is that a reasonable royalty should reflect what would happen as a result of well-informed ex ante technology competition. *See* Lemley & Shapiro, *supra* note 2, at 1148 (holding that the incremental value of the patented technology over and above the next-best alternative serves as an upper bound to the reasonable royalties).

This definition of value – the gain over an alternative – is deeply rooted in economic theories of market competition and competitive equilibrium. In such theories, competitive equilibrium is determined by consumers and producers choosing their best alternative while foregoing their next-best alternative, the gain over the foregone alternative being the incremental value of the best alternative. When all consumers and producers behave in this fashion, the resulting equilibrium price causes the market to "clear": supply equals demand.[55] That price is, in a fundamental sense, "fair" and "reasonable," on the one hand, and "efficient" and "consistent" on the other.

But competing for selection into a standard is not a "market competition." No prices are involved, because the discussion of prices (and commercial terms more generally) is banished from the standardization process.[56] Therefore, a firm proposing a technical contribution cannot reduce its "price" in an effort to increase the likelihood of making a "sale" to the SDO. In mathematical terms, profit is not a differentiable function of price, because the price of the contribution is irrelevant to the SDO's decision and therefore to the contributor's profit.[57] The only thing that matters to the SDO is the quality of the contribution.

But even more fundamentally, standardization is a winner-take-all process, in which – unlike market competition – there can be only one winner, by definition. And unlike market competition, the value of winning is the difference between serving 100% of the market and serving 0%. Again in mathematical terms, since quantity outcomes are binary – all of the market, or none of it – profit is not a differentiable function of the level of output. Standardization thus magnifies the difference between winning and losing, relative to market competition.

To see this in a simple example, suppose that in period 1 two firms conduct R&D, each spending 50. In period 2, they compete in a product market, based on the results of their R&D in the first period. Firm A's invention is superior, so (relative to its normalized profit

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55. *See* Varian, *supra* note 4, at 293-315.

56. *See, e.g.*, ETSI IPR Policy, *supra* note 12.

57. For $f(x)$ to be differentiable function of x, the value of $f(x)$ must vary smoothly as a function of x. Because profit ($f(x)$) does not vary smoothly as a function of price (x), the function is not differentiable.

without doing any R&D) it earns 60 in period 2, while Firm B earns 40.[58] Two results follow: (1) the aggregate return on R&D in period 2 (100) is just sufficient to justify the aggregate R&D investment in period 1 (100), even though Firm A earns a modest positive return on its investment (+10), while Firm B earns a modest loss (–10); (2) the "incremental value" of Firm 1's invention over Firm 2's is 20, while its "incremental value" over the "no R&D" outcome is 60.

Now suppose instead that competition in period 2 is standardized, with both firms using Firm A's invention. Because of the gains from coordination, the aggregate return increases to 110.[59] Suppose that the gain from coordination (110 – 100 = 10) should not be imputed to the invention, but to the standard's implementers and their customers, so neither Firm A nor Firm B can lay claim to it. But that result begs the question: what reward should the winning innovative firm (Firm A) receive?

Under the standard paradigm (static standardization), R&D is irrelevant; the inventions "already existed." Thus, if one were to ignore the costs of R&D, one would conclude that the "incremental value" of A over the next-best alternative is 20.[60] But precisely because it ignores the cost of R&D, that conclusion is erroneous. If Firm A knew that it would receive a reward of 20 following an investment of 50, it would never have invested 50 in the first place, because it would lose money.

Advocates of the standard paradigm often point out that R&D is a risky activity, that there is no guarantee that R&D will be

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58.   These results can be generated more formally. Consider a Cournot model, in which two firms A and B sell a single homogenous product and maximize their own profits by choosing the optimal quantity to produce, given the other firm's quantity. If Firm A's invention confers on its owner a greater cost advantage than does Firm B's invention, then in equilibrium Firm A's market share will exceed Firm B's. *See* Varian, *supra* note 4 at 509. This additional structure is, however, unnecessary to the basic point.

59.   Because both firms are using A's superior invention, the aggregate return should increase still further. For present purposes, we abstract from this additional gain.

60.   *See* Microsoft Corp. v. Motorola Inc., 696 F.3d 872, 898 (9th Cir. 2012) (providing an additional example of how to use an incremental approach to determine reasonable royalties). Using an example to explain this incremental approach, Dr. Murphy stated:

> What you'd ideally like to do is sit down and say: Okay, Kevin, you've contributed this piece of technology. Bob had this alternative piece of technology we could have used instead of yours. Yours was some increment better than his, that is the value you added, because we could have used his rather than yours, so your net contribution was that amount. And that's what you should get as a reasonable royalty.

successful, and there is nothing about an SDO's IPR policy or the assurance of "fair" compensation that guarantees a positive return on investment. All true enough. But in order for the investment to be "incentive compatible" – meaning that a rational firm would undertake it in the first place[61] – the firm must *expect* the return on its investment to be non-negative. In other words, while acknowledging the possibility of losing money, a rational firm will only invest if it *expects* to break even or better, on average. The "incremental value" rule, as applied in this fashion, does not satisfy that requirement.

A more thoughtful approach recognizes that R&D is costly, and awards 60 to Firm A: 20 (the increment over Firm B's alternative) plus 40 (the increment of Firm B's alternative over the "no R&D" status quo ante). This approach also yields a positive return on R&D for Firm A: $(60 - 50) / 50 = 20\%$, the same as it would have received under market competition. Surely this is the correct result? Yet this "incremental value" approach is also erroneous.

The reason for the error is that, in the market example, the winner takes 60 and the loser takes 40. In a standardized competition, the loser takes *nothing*. In other words, standardization creates (complete) losers, as well as (complete) winners. The risk of going home empty-handed, instead of with just a modest loss, is something that a rational firm must take into account when deciding whether or not to invest. Thus if Firm A and Firm B each had a 50% chance of winning the R&D competition *ex ante*, and each spent 50 on R&D, then each would have had to expect a reward of at least 100 in the event that he won, to offset the 50% chance that he will receive 0: $50\% \times 100 + 50\% \times 0 = 50$. When adjusted for the risk he bore, the winner's realized prize of 100 – a return on his investment of $(100 - 50) / 50 = 100\%$ – only causes him to *break even* in expectation. If the reward were 98, not 100, then the winner would expect to receive $50\% \times 98 + 50\% \times 0 = 49$. No rational firm will spend 50 with certainty to make 49 on average.

Put differently, the "incremental benefit" of winning the standardization contest is $100 - 0 = 100$, not 20 or 60. Thus, if the winner were to receive only 60, based on an *ex post* calculation of his

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    61. An "incentive compatible" economic mechanism is one in which the behavior expected of an economic agent is the same as what the agent would choose, acting in its own profit-maximizing interests. ANDREU MAS-COLELL, MICHAEL D. WHINSTON AND JERRY R. GREEN, MICROECONOMIC THEORY, 857-925 (1995).

invention's supposed "incremental value," the winner would, of course, still accept the award, and would still "make money." 60 – 50 = 10. But this proposed policy is "dynamically inconsistent," because it *fails to induce the investment that each competitor actually made.* Had the competing innovators known, at the time of their original investments, that their reward would be 60, then they would have only expected to earn 50% x 60 + 50% x 0 = 30, and therefore would not have invested 50. In fact, the same is true for *any other* reward limited to the *difference* in their "market outcomes": neither firm would have made the R&D investment, no innovation would have occurred, and there would be nothing to standardize or coordinate. Dynamic inconsistency is, therefore, a serious logical error in policy design, because it depends on being able to bait investors with the promise of a large reward, then switch to a small reward.[62] In short, the "incremental value" policy depends on changing the rules of the game *after* the innovators have sunk their R&D investments – the classic definition of hold-up.

This is the critical difference between Figure 1 and Figure 2: in Figure 1, the technology that is selected into the standard is assumed to exist already, so selection into the standard is simply a windfall gain to the winner. But in Figure 2, the technology that is selected into the standard is the result of a costly R&D competition in which there is one winner and many losers – as shown by the fact that, at the point in time that the winner is licensing its technology, each loser receives "< Nothing >". For this system to be economically rational, the winner's compensation must pay the cost of *everyone's* R&D – not just its own.

The foregoing discussion assumes that the innovative process is the same under both market competition and standardization. But standardization has other beneficial effects on R&D. Standardization

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62. "Dynamic inconsistency" results when a decision-maker's preferences differ at two points in time, such that a threat or promise made at one point in time is not credible. For example, to induce investment in innovation in period 1, consumers would like to promise to pay a reward to an innovator, should the investment be successful. But when the innovation actually occurs in period 2, consumers would prefer not to pay the reward. Foreseeing this, the innovator will not invest unless consumers can credibly commit to paying a reward in the future sufficient to induce the investment today, without reneging. The patent system - which enables the innovator to exclude consumers from using the patented invention, unless they pay for it - is one example of such a credible commitment. *See* Paul Klein, *Time Consistency of Monetary and Fiscal Policy, in* THE NEW PALGRAVE DICTIONARY OF ECONOMICS (2008).

is a winner-take-all tournament. Tournaments encourage high-quality competition, which produces spillover gains not completely captured by the winner. For example, an exciting, well-played golf tournament offering a $1 million prize to the winner attracts a larger audience, and is therefore more profitable to its organizers, than a dull, sloppy tournament, as would likely occur if the second-place finisher were promised $500,000, while the winner were promised $500,000 plus $1 for each stroke by which she wins – that is, her gain over the "next-best alternative."

The standard method for increasing the quality of competition is to award a much larger prize to the winner than to the second-place finisher: with much at stake, even small performance differences translate into large outcome differences, so competitors work hard to obtain small advantages. In other words, *all* competitors work harder, making for higher-quality competition, even though only one ultimately "takes all." This phenomenon is observed, not just in sporting events, but in labor and other markets, as with competitions among senior executives to become the CEO of a company.[63] The sponsor of the tournament gains from the increased effort that *every* competitor puts into winning, even though *only one* ultimately wins.

The same is true of the competition to be selected into a standard: the stated goal of the competition is to ensure that the best possible invention is adopted into the standard. Tournament competition increases the expected quality of each winner selected from among the underlying outputs.[64] But, just as professional golfers are not rewarded based on the number of strokes by which they win, tournament-type, winner-take-all competition requires tournament-type, winner-take-all compensation – not the "incremental value" compensation derived from market competition.[65]

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63.   *See, e.g.*, Ellen Byron, *P & G Narrows Field For CEO Succession,* WALL ST. J. (Oct. 22, 2014), http://online.wsj.com/articles/p-g-narrows-field-for-ceo-succession-1414008126. *See also 2016 Executive Compensation--Proctor & Gamble Co.,* MORNINGSTAR, http://insiders.morningstar.com/trading/executive-compensation.action?t=PG.

64.   Under tournament competition, the market-wide improvement represented by the winning innovation is the "first order statistic" of distribution of invention quality, relative to the second-best alternative. *See generally* H. A. DAVID AND H. N. NAGARAJA, ORDER STATISTICS (3d ed. 2003). Under market competition, the market-wide average improvement is a function of all improvements (that is, all N order statistics) drawn by each of the N market competitors, each improvement relative to its next-best alternative.

65.   It should be noted that nothing in this observation supports hold-up or any other excessive royalty award. The point is to support a self-sustaining compensation mechanism,

This extended discussion is necessary because FRAND arbitrators are likely to be told that computing a standardized invention's "ex ante incremental" value is the only legally and economically acceptable method for valuing it.[66] In fact, standardization eliminates both the "ex ante" and the "incremental" elements of the market-based paradigm. The "ex ante incremental" method is therefore conceptually incorrect, empirically non-implementable, dynamically inconsistent, and systematically under-compensates innovators. Arbitrators should resist entreaties to entertain, much less rely on, any such method.[67]

Arbitrators should also resist the parallel claims that (a) the only thing required of an arbitrator is to calculate a "FRAND rate," and (b)

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under which innovators expect to earn a normal return on their investments. To say that the static paradigm fails to provide that support is not to argue for excess in the other direction.

66. The idea that a reasonable royalty should reflect the ex ante value of the patented technology, over and above the next-best alternative, is far from new. This is the approach recommended by the Federal Trade Commission. The European Commission also takes this approach. *See* Joseph Farrell et al., *Standard Setting, Patents, and Hold-Up*, 74 ANTITRUST L.J. 603, 616 (2007) (discussing that a patented technology's ex ante value should reflect a reasonable royalty); *see also* Daniel G. Swanson & William J. Baumol, *Reasonable and Nondiscriminatory (RAND) Royalties, Standard Selection, and the Control of Market Power*, 73 ANTITRUST L.J. 1, 15 (2005) (describing the ex-ante auction model).

67. This point has profound antitrust implications. Antitrust policy is based on well-known definitions of a "relevant market," "market power" and related concepts.

To define a relevant antitrust market (which comprises "close [economic] substitutes"), one must employ market prices (which form the basis for the economic definition of "close substitutes"). But as we have seen, prices are irrelevant to the standard selection process, so there is no *ex ante* price by which to identify "close [*economic*] substitutes." Similarly, "market power" is "the ability to maintain price above the competitive level"; again, prices for technical contributions do not exist "ex ante," so there is necessarily no basis for comparing them to a "competitive price level," and therefore no way to determine whether any given *ex post* price exhibits "market power," either. And, even if one were to insist that a market-based antitrust analysis apply to non-market competition, one must distinguish between the (multiple) competitive prices expected under market competition (in which those who finish second or lower in the R&D competition also participate in the market), – and the (single) winning price expected under tournament competition (under which the price for every losing contribution is *zero*). Static antitrust doctrine is unable either to make this distinction conceptually, or to measure this benchmark price empirically.

See generally Horizontal Merger Guidelines, U.S. Dept of Justice and Federal Trade Commission, Aug. 19, 2010, https://www.justice.gov/atr/horizontal-merger-guidelines-08192010 [https://perma.cc/H9PR-XQN8].

the calculation of such a rate is "simple."[68] As a purely contractual matter, the licensor commits to be prepared to license on "FRAND terms and conditions," not to a "FRAND rate."[69] But because the rate depends, logically and economically, on other contract terms, the proper comparison of contracts does not permit one to simply interpret the rate – or any other contract term – in isolation.[70]

This general principle of contract interpretation is true in the FRAND context, in particular. In actual contracts that have been found to comply with the ETSI FRAND undertaking,[71] some of the

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68.   *See* Lemley & Shapiro, *supra* note 2 ("If one party argues for a lump sum and the other for a running royalty, the arbitrator is choosing between apples and oranges. That makes the arbitrator's job harder, but by no means impossible; she *simply* must decide which approach better reflects what hypothetical negotiators would have chosen in that particular instance. If necessary, she can specify the royalty structure (e.g., lump sum vs. running royalties, or the royalty base to be used) to facilitate an apples-to-apples comparison of the rates proposed by the two parties. Beyond this, we do not think the arbitrator needs to or should resolve disputes over other non-price license terms. A FRAND license is by definition neither temporally limited nor limited to producing a set number of products; it provides terms that apply whenever the licensee makes products implementing the standard during the term of the patents.").

69.   *See ETSI Guide on Intellectual Property Rights (IPRS), supra* note 12 ("Declarant and/or its AFFILIATES are (1) prepared to grant irrevocable licenses under this/these IPR(s) on *terms and conditions* which are in accordance with Clause 6.1 of the ETSI IPR Policy") (emphasis supplied).

70.   The comparison of licenses also occurs outside the FRAND context. For example, when one licensee has bargained for terms that are at least as favorable as those granted to any other licensee (a so-called "most-favored licensee"), the comparison of terms depends on the entire agreement:

> Whether a later license is more favorable thus depends upon the total package of consideration flowing both ways, not upon any single rate or term in isolation. The standard for evaluating the total package of consideration is an objective one; the licensor is not allowed to determine on its own what terms are more favorable. Among the things that courts may consider as part of the package are cross-licenses under conflicting patents, releases from restraints in litigation, and the licensor's indemnification of later licensees against infringement claims by third parties. The scope of the license of course is also important. To the extent consideration can be evaluated, courts weigh these and other relevant factors in an attempt to compare the net competitive value of later nonexclusive licenses with the net competitive value of terms granted the most favored licensee.

JAY DRATLER, JR., LICENSING OF INTELLECTUAL PROPERTY § 9.02 (2017). While the determination of FRAND terms and conditions may also involve the comparison of licenses, it is important to emphasize that a licensor's FRAND undertaking is not a commitment to grant most-favored licensee terms or status.

71. *See* Certain 3G Mobile Headsets, Inv. No. 337-TA-613 USITC Pub. 4145 (Apr. 2015) (Remand) (Public Version):

> [InterDigital] has been negotiating with [Respondents Nokia and its successor Microsoft Mobile Oy], and in as much as the [R]espondents have not provided

determinants of the royalty rate include: the term of the agreement; the structure of the contract (fixed or running); the price of the licensed product; caps and/or floors on the price of the licensed product; the volume of licensed units; the extent to which the royalty is pre-paid; the geographic region in which the sale takes place; the evolution of the composition of the patent portfolio over time (through expirations, acquisitions, divestitures, etc.); and the terms of release for past infringing sales.[72]

Because such terms are interdependent, it is not possible to exhaustively characterize the matrix of effects resulting from a change in one term on each of the other terms. But in Table 1, I have suggested the direction that a change in the indicated term might be expected to have on "the rate" implicitly or explicitly paid by the licensee.

Table 1: The Potential Effects on the FRAND Royalty Rate from Changing Non-Rate Contract Terms

Contract term or condition	Change in contract term	Potential effect on royalty per unit	Reason
Contract length	Longer contract	Negative	Longer contracts reduce uncertainty and recontracting costs

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evidence of what a FRAND rate would be, and what duties of good faith have been violated by InterDigital, there is no evidence that [InterDigital] has violated its duty of good faith, or tried for a patent holdup. As was the case in the 868 investigation [also involving InterDigital] the evidence presented does not support the Respondents' position that InterDigital has violated a FRAND obligation by filing this complaint at the ITC. The negotiation has continued in good faith, and *there are many more issues than the rate of payment to be made*, as the evidence presented by both sides has demonstrated. (emphasis added).

72.   This list is not only not exhaustive, but it also does not imply that any individual term is or is not "FRAND," taken on its own. *See* Dratler, *supra* note 70 (licenses, like other contracts, must be evaluated as a whole).

Contract structure	Running to fixed	Negative	By committing upfront, licensee assumes greater risk; no distortion of marginal production cost
Price of licensed unit	Higher price	Positive	If rate is expressed as fixed percent of price, payment increases
Price caps	No cap to cap	Negative	A cap limits the portion of price subject to royalty
Price floors	No floor to floor	Positive	A floor defines a minimum payment regardless of price
Volume of units	Increase in volume	Negative	Volume discounts incentivize greater licensed sales and royalties
Pre-payment	No prepayment to some	Negative	Licensee assumes greater risk; increases licensor capital
Geographic region	Worldwide rate to regional rates	Positive/ negative	Regional rates reflect local conditions; usually lower in Asia
Evolution of portfolio size over time	Increase / decrease	Neutral	Rates reflect average portfolio composition over contract term; they are not "marked to market"
Release payment	Larger payment for past sales	Negative	Past royalty obligations are not amortized over future sales

The changes and justifications shown in Table 1 are not definitive. There may be multiple justifications for any given contract term; more generally, the parties may have competing (or contradictory) justifications for agreeing to any given term. The point is simply to show that, if one is to consider the terms and conditions of a real-world license agreement, "the rate" cannot be evaluated in isolation from the other terms.

Because of this complex interdependence among contract terms and conditions, it is "simple" to disprove the hypothesis that the

computation of a "FRAND rate" is "simple." On the contrary, the comparison of licenses is fraught with ambiguity, precisely because the licensor has undertaken to be prepared to grant a license on (multi-dimensional) "FRAND terms and conditions," not a (one-dimensional) "FRAND rate." To make matters worse, such comparisons must usually be filtered through academic commentary divorced from real-world contracts, incompetent (or worse) economic testimony, and/or the decisions of prior arbitration panels. The next sections explore these difficulties in turn.

III. INTRA-ARBITRATION ANALYSIS OF LICENSES

While the licensing of standardized patents can take many forms, one archetypal license structure is the "cross-license with balancing payment," or a "fixed-payment cross-license." Such licenses are common when the overarching objective of each party is to ensure the "freedom to operate," by avoiding all sources of patent conflict between the parties. This objective is common to the FRAND context, but it is not limited to that context.[73]

In fixed-payment cross-licenses, each party grants to the other blanket permission to a set of its patents: "all patents"; "all patents essential to implement standard X in product Y"; etc. The license may cover a fixed time period, or it may extend to the life of the patents. The license generally does not enumerate the licensed patents. In the context of a license to "standard-essential patents" subject to a FRAND obligation, this means that any given patent may or may not be licensed, depending on whether it does or does not meet the definition of an "essential" patent under the SDO's IPR policy.[74]

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73. Peter C. Grindley and David J. Teece, *Managing Intellectual Capital: Licensing and Cross-Licensing in Semiconductors and Electronics*, CALIFORNIA MGMT. REV. 39 (1997) (explaining that because of the potential for mutually blocking patents, firms employing "cumulative technologies" typically cross-license all patents in a field-of-use to ensure adequate access, or "freedom to operate"; the strongest examples of cumulative technologies are computers and semiconductors).

74. This is just one of the reasons why patent damages law is sometimes ill-suited to guide a FRAND arbitration. In a patent damages case, an individual patent is assumed valid and infringed. In looking to "comparable licenses," however, the trier of fact not only does not find a license that priced the individual asserted patent (because prior licenses generally are portfolio licenses), but cannot even determine whether the asserted patent was licensed *at all* in the prior licenses (because the prior licenses made the license grant conditional on a finding of essentiality, a finding that generally has not been made one way or the other).

Critically, fixed-payment licenses also do not contain a "rate" of any kind. The only "economic term" is a fixed payment from one party to the other. In a cross-license, that fixed payment reflects the parties' agreed estimate of the net of each party's aggregate claim on the other. Licensed patents, royalty rates, units sold – none of these are to be found in the archetypical agreement. For an arbitrator or other "rate-setter" whose ostensible task is to determine a "FRAND royalty rate" – leaving aside the question of how that "rate" interacts with the contract's other terms and conditions – the empirical question is how to infer the "rate" implied by each such rate-less agreement.

A.   *Contractual Indeterminacy*

To fix these ideas, and to illustrate the difficulties the arbitrator faces, it is helpful to employ a simple example. Suppose that the arbitrator wishes to interpret a fixed-payment cross-license entered into between two firms, 1 and 2. The only economic term in the contract is that "Firm 1 shall pay Firm 2 $1."

A natural first step in the analysis of this agreement is to determine the respective licensed sales of the parties; presumably, these quantities helped determine the claim that each party made on the other. For simplicity, I assume that these quantities are known with certainty: Firm 1 sells $200 of licensed units, while Firm 2 sells $100. Having larger sales, Firm 1 is said to have the larger "royalty exposure." That fact helps explain why, in the actual agreement, Firm 1 pays $1 to Firm 2.

As Table 2 shows, however, knowing each party's sales plus the $1 balancing payment from Firm 1 to Firm 2 is not sufficient to determine either party's claim on the other – nor is it sufficient to infer the implied "rate" per dollar of sales.

Table 2: The Same Balancing Payment Implies Multiple Combinations of Rates

	Scenario A	Scenario B	Scenario C
Firm 2's claim			
Firm 1's sales	$200	$200	$200
Firm 2's rate	*3%*	*1.5%*	*0.5%*
1 owes 2	*$6*	*$3*	*$1*
Firm 1's claim			
Firm 2's sales	$100	$100	$100
Firm 1's rate	*5%*	*2%*	*0%*
2 owes 1	*$5*	*$2*	*$0*
Balancing payment from 1 to 2	**$1**	**$1**	**$1**

The problem illustrated in Table 2 is that there are multiple combinations of rates (shown in italics) that could have generated the observed net payment between the parties. In fact, there are an infinite number of such combinations. Those combinations are given by the line in Figure 3. Insofar as the arbitrator is (erroneously) tasked with determining a single "FRAND rate," the question to be resolved is: where are the parties on this line?

Figure 3

Royalty rate pairs that yield a $1 balancing payment
Firm 1 sells $200
Firm 2 sells $100
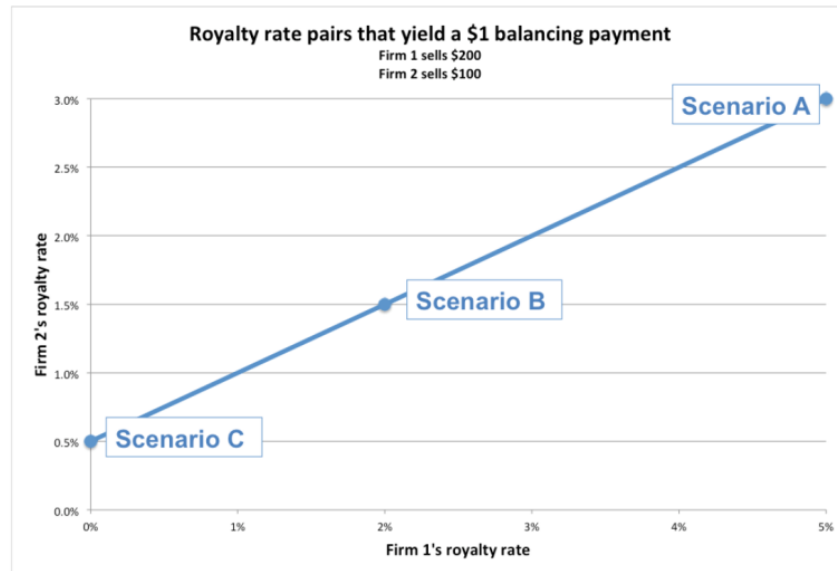
Thus, the irreducible problem with inferring "the rate" from a fixed-payment cross-license is *indeterminacy*: without bringing in information from outside the contract, it is impossible to determine "the rate(s)" to which the parties (implicitly) agreed within the contract.

B.   Private Beliefs

In the prior example, indeterminacy arose even though we assumed that market conditions were known with certainty. Of course, in the real world the parties do not know their future sales with certainty. Instead, they form certain beliefs about the future, based on their own private information. Those private beliefs may, or may not, coincide with the beliefs formed by others, based on public information. As a classic example, Apple knew the attributes of the iPhone before its launch, but its counter-parties did not know these attributes. Among those who predicted failure, or at best limited success, for the iPhone were the chief executive officers of Microsoft,

Blackberry (Research in Motion), Nokia, Palm, and Motorola.[75] Thus Apple's 2007 expectations of future iPhone sales undoubtedly differed from those of "the market" (which differed, in turn, among market analysts and insiders).[76]

In general, parties need not and do not share their private beliefs in license negotiations (subject to the general duty to negotiate in good faith).[77] Thus, when we relax the assumption that future licensed sales are known, we immediately confront the question: What were the expectations of the parties? To that question, there is usually no unambiguous answer.[78]

From the fact that the negotiating parties eventually reached agreement, one might infer that they shared similar beliefs. But that inference is untrue. As Table 3 shows, parties can believe completely different things about the future, and yet come to agreement on a contract's only economic term. Again, we assume two firms, but

75. Kif Leswing, *Nine People Who Knew the iPhone Was Going To Be A Flop*, BUSINESS INSIDER, (June 29, 2017), http://www.businessinsider.com/9-people-who-knew-the-iphone-was-going-to-be-a-flop-2017-6 [https://perma.cc/J4BS-BSZZ].

76. *See id.* It should be noted here as well that some "neutral" technology analysts thought the iPhone would fail as well.

77. Sometimes the parties are forbidden from sharing private information, for example because they have entered into other agreements that require confidential treatment. In general, the confidentiality of such private information, and the asymmetry of information that it introduces into license negotiations, are normal and recognized features of commercial transactions. *See ETSI Guide on Intellectual Property Rights (IPRS),supra* note 12 ("It is recognized that Non Disclosure Agreements (NDAs) may be used to protect the commercial interests of both potential licensor and potential licensee during an Essential IPR licensing negotiation, and this general practice is not challenged. Nevertheless, ETSI expects its members (as well as non-ETSI members) to engage in an impartial and honest Essential IPR licensing negotiation process for FRAND terms and conditions.").

78. Even when a party's internal documents are discoverable in litigation, they could have been prepared with discoverability in mind, and could thus contain "strategic" expectations designed to reinforce the party's expected future legal position, should litigation occur. Thus, in addition to trying to determine private beliefs, the finder of fact may also confront questions about the sincerity of those beliefs.

"Sincerity" is not, of course, an economic concept; economic analysis is generally limited to determining the extent to which the *ex post* assertion of an *ex ante* belief is consistent with other *ex ante* information and expectations. Such determinations sometimes lead to the economic inference that a claim is "not credible." Here, "credibility" does not mean the same thing as it does in a courtroom, where credibility determinations belong exclusively to the trier of fact. In economics, "credibility" refers to the consistency of a statement or purported course of action with the economic agent's actual interests. For example, to say that a threat to engage in a price war is "not credible" is to say that it is not in the interests of the economic agent to follow through on the threat. Saul Levmore and Ariel Porat, *Credible Threats*, (Coase-Sandor Institute for Law and Economics, Working Paper No. 692, 2014).

focus only on the parties' beliefs about Firm 1's sales. Firm 2 must rely on public information about Firm 1's product; based on that information, Firm 2 believes that Firm 1 will sell $100. In contrast, Firm 1 knows the future attributes of its product; based on that private information, Firm 1 believes that it will sell $200.

With respect to "the rate" to be inferred from the contract, Firm 2 believes, based on its (private) knowledge of its other licenses, that its patents command a royalty rate of 1% of sales. Firm 1, which cannot observe these licenses, believes that the royalty rate should be 0.5%.

Table 3: The Same Royalty Payment Arises From Different Beliefs About the Facts

	Firm 1's belief	**Firm 2's belief**
Firm 1's sales	*$200*	*$100*
Firm 2's royalty rate	*0.5%*	*1%*
1's agreed royalty payment	**$1**	**$1**

As Table 3 shows, even though the parties believe entirely different things about the factual determinants of the royalty payment (the italicized values), they nevertheless agree on the payment itself. And that payment is the only economic term observed in the contract. If an arbitrator or other outside observer were to suggest that the "FRAND rate" to which the parties agreed were 1%, Firm 1 would vehemently disagree; and if the observer suggested the rate were 0.5%, Firm 2 would vehemently disagree. Thus, when justifying to an arbitrator Firm 2's offer to a third party ("1% of sales"), Firm 2 can point to its license with Firm 1 to confirm the "fair, reasonable and non-discriminatory" nature of its offer – an assertion that *the other party to the same contract* would deny.

It is also important to note that Firm 2's beliefs may have been legitimate, based on the information it had available at the time, but that those beliefs subsequently turned out to be wrong, while Firm 1's were correct. Thus suppose that, in the event, Firm 1 sells $200, for which Firm 2 receives a $1 royalty. It is tempting to argue that the "effective rate" of Firm 2's patent portfolio is $1 / $200 = 0.5% – and

that the same "true effective rate" should be given to others as well. But that argument is wrong: it imports into the inference information about the future (Firm 1's actual sales) that neither party possessed at the time of the negotiation. Just as it is conceptually wrong to infer the "correct" insurance premium that should have been paid for a fire insurance policy from the (unknown, future) fact that the insured's house actually did not burn down, it is conceptually wrong to infer the "correct" royalty rate for a licensor's technology from the (unknown, future) fact of the licensee's actual sales.[79]

As the next section illustrates, the "economic analysis" of standard-essential patent licenses is rife with these and other such abuses.

C. Summary

Two of the most important parameters of a patent license are the *structure* (fixed payment or running royalty) and *direction* (one-way or two-way) of its payments. The possible combinations of these parameters are shown in the grid of Figure 4 below. The simplest license, from the point of view of inferring a rate, is a running royalty payment from a licensor to a licensee: "Firm 1 pays Firm 2 1% of sales." Such a license is shown in the upper-left quadrant of the grid. In contrast, a "fixed payment cross-license" – the most common form of a standard-essential patent license, in which "Firm 1 pays Firm 2 $1" – occupies the lower-right quadrant of this grid.

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79.   Such inferences are also inevitably opportunistic. If instead of selling $200, Firm 1 had sold $50, the same calculation leads to an implied "effective rate" of $1 / $50 = 2%. Needless to say, no third party would advocate that it should pay Firm 2's "true effective rate" of 2%, when Firm 2 itself has offered a rate of 1%. Here, as elsewhere, third parties who advocate the use of information that was unavailable to the contracting parties at the time they contracted do so selectively, in an effort to bias inferences in their favor. Again, arbitrators should firmly resist such attempts (except to the extent that future events can be shown to *confirm* the beliefs that a party held, based on the information it actually possessed, at the time of contracting).

Figure 4: Patent License Payment Structures and Directions
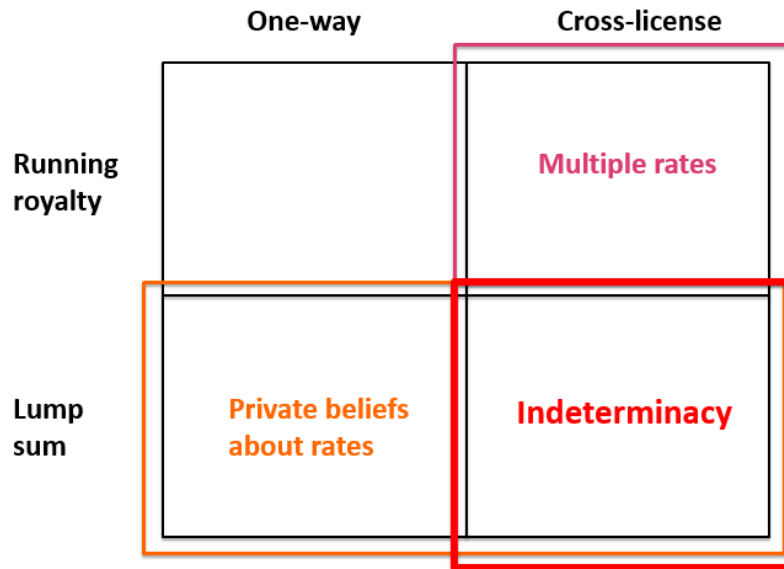
For cross-licenses, the fundamental inferential problem for outside observers is *indeterminacy*: there are an infinite number of possible rates that give rise to the observed payment. For fixed-payment agreements, the fundamental inferential problem for outside observers is *private beliefs*: each party contracts based on its expectations about the future, but those expectations need not be shared or even observable. Inferences from a fixed-payment cross-license are afflicted by both these problems.

In short, as Figure 4 shows, from the point of view of drawing reliable inferences about the "FRAND rate," we most frequently find ourselves in the worst of all worlds: trying to interpret contract terms that imply, on one hand, an *infinite* number of mutually acceptable "rates," and, on the other, contradictions producing *zero* mutually acceptable "rates."

In the face of these difficulties, parties unsurprisingly enlist the help of economic experts to persuade arbitrators of the correctness of their economic positions. But unless those experts recognize these fundamental problems, they are doomed to make the situation worse, not better. That is, unfortunately, the most frequent outcome.

IV. ECONOMIC TESTIMONY IN FRAND ARBITRATIONS

Tolstoy observed that "Happy families are all alike; every unhappy family is unhappy in its own way."[80]

Like unhappy families, each "unhappy" economic testimony exhibits its own idiosyncratic failings and abuses. Thus, there can be no systematic way to warn prophylactically against such errors. What follows is an effort to categorize some of the more easily recognized and frequent abuses.

A.   *"Effective" Rates*

1. Comparing Contractual with Non-contractual Terms

As the preceding section illustrated, it can be difficult or impossible to infer a "rate" from a contract in which a "rate" does not appear. But that fact does not prevent economists from trying to "assist the court" by creating "rates" where they do not exist. The name typically given to such creations – an "effective rate" – carries an almost irresistible pull, as though it *should* tell the observer something about the "true rate." More often than not, that claim is false.

First, as Figure 4 shows, a contract in which the parties have bargained for a rate is fundamentally different from a contract in which the parties have not struck such a bargain. In a contract having a rate, the licensee commits to pay an amount per unit; units are an essential term of the contract. In a contract not having such a rate, the licensee commits to paying a fixed amount; the number of units is irrelevant. Thus, a contract in which the licensee pays $1 per unit and is expected to sell 100 units is fundamentally different from a contract in which the licensee pays $100 and can sell as many units as it pleases. The risks, cost structure, liquidity requirements, and effect on price of the two contracts are different; the *economics* are different. No amount of calculations by an economic expert can convert one type of contract into the other.[81]

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80. LEO TOLSTOY, ANNA KARENINA 1 (1878).
81. Lucent Technologies, 580 F.3d at 1325-32 (discussing at length the relevant legal and economic differences between running royalty and fixed-payment contracts).

Yet, despite their extensive training in the drafting and interpretation of contracts, including the often-adversarial process of selecting a unique combination of terms that satisfies both parties and that trades off one party's concerns against the other's, lawyers, judges and other neutrals are (in the author's experience) often easily convinced that there *ought* to be some mathematical way to compare the "economic terms" of two contracts, using a single number. The invitation to abandon settled principles of contract interpretation (requiring that terms be evaluated jointly), in favor of an economist's reductionist, one-dimensional calculation, is often hard to resist, at least for the mathematically untrained. Resistance is even more difficult when there exists a legal norm like "non-discrimination," which seems virtually to require that such one-dimensional comparisons be made, to establish or refute a claim of discrimination.

Example 1. To see how matters can go wrong, consider the ways that some economists handle the comparison of running royalty and fixed-payment contracts. Licensee A, who agrees to a \$1 per unit royalty, owes \$200 if sells 200 units; the contractual rate is \$1/unit. Licensee B, who agrees to a fixed payment of \$100, owes \$100 if it sells 100 units, or 200 units; there is *no contractual rate*. However, in the event that sales are 200 units, an economist may compute an "effective rate" of \$100 / 200 = \$0.50 per unit. He then compares B's agreement to A's, and argues that B's contract exhibits a "lower rate." But that argument is erroneous: the economist is comparing a contractual term, for which the parties bargained, with a non-contractual term, invented by the economist. Thus, the first analytical error is "comparing the contracts" by comparing contractual with non-contractual terms.

A related, but conceptually distinct point is this: if one assumes that each licensee sells 200 units, then Licensee B received the lower "effective rate." If instead one assumes that each licensee sells 50 units, then Licensee A received the lower "effective rate." But these comparisons depend on knowing the actual number of units that will be sold – a fact that the parties did not know when they contracted. Thus, the second analytical error is comparing the contracts using

hindsight, by imputing to the parties information about the future that they did not have.[82]

2. Example: Price Caps

Once one discovers how to compute non-contractual "effective rates" and to compare them with contractual rates, the potential for mischief is virtually unlimited. For example, consider the common practice of including "caps" on royalty payments. One justification for a cap is that the licensed device (such as a smartphone) contains components (such as a diamond-studded case) whose value is unrelated to the licensed technology. The licensee argues that it should not pay a royalty on that portion of the device price "above" the portion attributable to the licensed technology.

Example 2. To implement a cap, the parties agree to a maximum payment per unit, regardless of its price: for example, "1% of price subject to a cap of $2 per unit." In this case, the royalty payment increases smoothly until the price of the licensed unit reaches $200, at which point it reaches the cap; no further payment is required on that unit. Suppose that Licensee A sells a device priced at $300, and agrees to these "rate + cap" terms. Then, because the cap is binding, its payment will be $2 per unit – an "effective rate" of $2 / $300 = 0.67%. Suppose Licensee B also agrees to a 1% contractual rate with a $2 cap – the same contract. But Licensee B sells a device priced at $150. In that case, because the cap is not binding, the "effective rate" is $1.50 / $150 = 1%. An economist comparing "effective rates" will conclude that Licensee B has suffered "discrimination" because it pays at a higher "effective rate" – even though both parties negotiated the *exact same terms*. Again, this comparison and conclusion are erroneous: the difference in "effective rate" is not due to *differential treatment by the licensor*, but to *differential behavior by the licensee*.

Example 3. In more complex and realistic contracts, the potential for abuse worsens. Consider the case in Figure 5, which generalizes the "cap" example slightly by allowing each firm to sell two types of handsets, a high-price handset (at $400), and a low-price handset (at $100). Each firm sells 100 units. They differ only in the mix of

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82.   Again, if the "information from the future" is an accurate proxy for the expectations of a party at the time of contracting, then this potential distortion may be eliminated. But the question remains: if private expectations differ, *which* party's expectations are controlling?

handsets they sell: Licensee A sells mostly low-price units, while Licensee B sells mostly high-price units. But they also negotiate different license terms: Licensee A pays royalties at the rate of 1.25% of sales, subject to a $2 cap, while Licensee B pays at the rate of 2% of sales, subject to a $3 cap.

Figure 5: "Worse" Terms Yield a "Better Effective Rate"

Contract terms	Licensee A	Licensee B
Contractual rate	1.25%	2.00%
Cap	$2.00	$3.00
Handsets		
High price handsets	$400	$400
Low price handsets	$100	$100

	Licensee A					Licensee B				
Sales	Price		Units		Royalty base	Price		Units		Royalty base
High price	$ 400	x	11	=	$ 4,444	$ 400	x	78	=	$ 31,111
Low price	$ 100	x	89	=	$ 8,889	$ 100	x	22	=	$ 2,222
Average / total	$ 133		100		$ 13,333	$ 333		100		$ 33,333
Royalties	Payment per unit		Units		Royalties	Payment per unit		Units		Royalties
High price	$ 2.00	x	11	=	$ 22.22	$ 3.00	x	78	=	$ 233.33
Low price	$ 1.25	x	89	=	$ 111.11	$ 2.00	x	22	=	$ 44.44
Average / total	$ 1.33		100		$ 133.33	$ 2.78		100		$ 277.78

	Licensee A	Licensee B
Total payments	$ 133.33	$ 277.78
÷ Total sales	÷ $ 13,333	÷ $ 33,333
= "Effective rate"	= 1.00%	= 0.83%

One might easily infer that Licensee B's terms are "worse" than Licensee A's: both its per-unit royalty rate *and* its per-unity royalty cap are higher. Yet, as Figure 5 shows, a comparison of their "effective rates" rejects this conclusion: because Licensee B sells a different mix of handsets, its "effective rate" is 0.83% – significantly *less* than the 1% "effective rate" paid by Licensee A.

The immediate lesson here is that "effective rates" are not only "not effective" for making one-dimensional comparisons between multi-dimensional contracts, but their use actively misleads the trier of fact, typically by suggesting discrimination where it does not exist. Economists who know this technique routinely abuse it; arbitrators believe them at their peril.

But the larger point is this: negotiating firms usually know their interests. Their decisions, particularly the contractual terms to which

they agree, generally should be relied upon as an indication of what is "fair" and "reasonable," absent compelling evidence to the contrary, because they have better information about their contemporaneous interests and beliefs than does an *ex post* trier of fact.[83]

The general principle – that contracts must be compared based on all of their terms, not on a single, non-contractual "effective rate" – should be uncontroversial. But FRAND litigants and their economic experts routinely flout it, both in litigation and in arbitration. Such attempts should be shut down *before* being evaluated on the merits, because they are legally erroneous.

For example, in *Certain Wireless Devices*,[84] the respondents argued that complainant InterDigital had violated its FRAND commitment by discriminating against them, based on an analysis of the ostensible "effective rates" that the respondents calculated from InterDigital's licenses. On the merits, no such discrimination was found. But as a threshold legal matter, the administrative law judge rejected the claim that such comparisons should be made at all:

> The FRAND nondiscrimination requirement prohibits "unfair discrimination," but it does not require uniform treatment across licensees, nor does it require the same terms for every manufacturer or competitor. Respondents base their argument that InterDigital's license offers are discriminatory on their calculation of the "effective royalty rate" of the offers. A nondiscrimination analysis, however, requires an examination of the whole of each license agreement, and not just the effective royalty rate.[85]

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83. The U.S. Supreme Court has defined "fair market value" as "the price at which the property would change hands between a willing buyer and a willing seller, neither being under any compulsion to buy or to sell and both having reasonable knowledge of relevant facts." *See* United States v. Cartwright, 411 U.S. 546, 550 (1973) (observing that "[t]he willing buyer-willing seller test of fair market value is nearly as old as the federal income, estate, and gifts taxes themselves.").

Fair market value is, in other words, the price observed in a (1) voluntary, (2) informed, (3) arm's length (4) exchange. Accounting and financial standards rely on the same principles, as does the U.S. Treasury. *See* Financial Accounting Standards Board, Statement of Financial Accounting Standards No. 157 40-45 (2006); Rev. Rul. 59-60, 1959-1 C.B. 237 (1959) (adopting *Cartwright* verbatim); Treas. Reg. § 20.2031-1(b) (1965).

84.   *See* Certain Wireless Devices With 3G Capabilities, Inv. No. 337-TA-800 (June 28, 2013) (Public Version).

85.   *Id.* at 432 (internal citations omitted).

Similar comparisons are routinely made between existing contracts, or between contracts and offers, involving volume discounts, regional royalty rates, released (past) sales and expected (future) sales, and similar contractual terms. In each case, the arbitrator is urged to forego the actual terms of the contract in favor of the non-contractual calculations of the economist. In each case, that suggestion leads to error.

B.   *"Comparable" Licenses*

These errors extend naturally to the choice of contracts that are employed for comparison. A contract that is alleged to be "comparable" for FRAND purposes is, in reality, selected by the economist because its terms can be manipulated to produce a more favorable "effective rate." In the FRAND context, the possibility of this kind of strategic manipulation of the evidence by the expert exacerbates the intrinsic difficulties posed by the indeterminacy and private beliefs reflected in any individual agreement.

An arbitrator can sometimes, as in Example 2, diagnose such errors by applying the terms of an allegedly superior contract to the circumstances of the supposedly disadvantaged licensee, and comparing the licensee's total payment under each set of terms. As in Example 2 (where the terms of the "better" contract were identical to those of the "worse" contract), this procedure can verify that the contracts are non-discriminatory, by holding constant the licensee's conduct and circumstances, and isolating the effects of the contract terms themselves.

C.   *The Downward "Non-Discriminatory" Spiral*

When relying on one or more "comparable" agreements for FRAND comparisons, economic experts frequently misinterpret and misapply the terms, to generate proposals for "equivalent" licenses that are economically and competitively unlike the agreements on which they rely. This procedure has the effect of *ensuring* that discrimination occurs – but *in favor* of the prospective licensee.

In the FRAND context, a particularly common and pernicious strategic manipulation of "effective rates" is the inconsistent treatment of running royalties. Such royalties are typically expressed either as a *percentage of price,* or a fixed *royalty per unit.* As long as

licensees differ in their prices, one of these expressions can always be manipulated to produce a better "effective rate."

For example, suppose that the licensor's benchmark agreement is a contract with Licensee *A* that defines the royalty as "1% of sales." Suppose that *A* has an average selling price of US$100, and so pays an "effective rate" of US$1 per unit. *B*, a prospective licensee with an average selling price of US$200, compares (1) the payment implied by *A*'s actual contract term (1% of US$200 = US$2 per unit) with (2) *A*'s "effective rate" (US$1 per unit), then demands the lesser of the two, arguing that anything else violates the licensor's FRAND undertaking not to discriminate. The licensor (or an arbitrator or other "FRAND rate-setter") then accedes to *B*'s demand. Seeing the licensor acquiesce to *B*, prospective Licensee *C*, whose average selling price is US$50, makes a similar comparison: (1) pay at *B*'s US$1 per unit actual contract term, or (2) pay at *B*'s "effective rate" of $1 / US$200 = 0.5%. Again invoking the licensor's FRAND commitment, *C* demands and receives "the same" 0.5% "effective rate" for itself, which results in a payment of 0.5% x US$50 = $0.25. Observing *C*'s deal, prospective Licensee *D*, whose average selling price is US$100 (the same as that of benchmark Licensee *A*), once again compares (1) the payment implied by *C*'s actual contract term (0.5% x US$100 = $0.50), with (2) *C*'s "effective rate" (US$0.25 per unit), and demands and receives "the same" "effective rate" for itself. The resulting "effective rate" – US$0.25 / US$100 = 0.25%) – is, of course, one-fourth the rate paid by Licensee *A* – even though Licensee *D* sells at *exactly the same price.*

The success of this strategic manipulation lies in swapping out the actual form of the rate found in each benchmark contract (percentage or per-unit) in favor of the "effective rate" expressed in the other form (per-unit or percentage) – thereby gutting each contract's actual term. Across multiple licensees, this process results in a persistent, immutable decline in the rates actually paid – the "downward non-discriminatory spiral." The central error lies in permitting each successive licensee to deviate from the express terms of the prior contract to improve its position, via an "effective rate," by invoking the "non-discrimination" provision of the licensor's FRAND undertaking.

This same downward spiral is generated by demands for other types of concessions: volume discounts;[86] fixed versus running royalty structures; and so on. Each licensee claims to want nothing more than "the same" deal as that negotiated by a prior licensee, yet the downward spiral ensues because licensees sometimes take account of price, volume or other differences between themselves and other licensees ("conditional uniform treatment"), and at other times ignore such differences ("unconditional uniform treatment"). The demand for non-discrimination, inconsistently applied, consistently causes discrimination to result.

While not applicable on the whole to FRAND licensing, the law of most-favored licensee ("MFL") clauses is informative as to how to analyze allegations of discrimination in the FRAND context.[87] The law requires an MFL licensee to accept both the good and the bad terms of a benchmark contract, rather than allowing the licensee to: cherry-pick only the helpful provisions of the contract (or not meet all of its conditions); choose individual provisions from multiple contracts; or fabricate fictional "effective" terms that are not, in fact, found in any contract at all.[88]

By adhering to this principle, arbitrators can reduce, if not eliminate, this kind of error when enforcing the actual language of an SEP owner's FRAND undertaking: ensure that a FRAND licensee receives only the entire package of "FRAND terms," not just a "FRAND rate" – and only after meeting the entire package of "FRAND conditions" that are actually found in a "comparable agreement."[89]

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86.   For example, large licensee *B* demands a volume discount (0.75%) relative to small licensee *A* (1%) (claiming that the failure to account for *B*'s larger sales volume constitutes "discrimination"); small licensee *C* demands "the same" rate as *B* (0.75%) (claiming that taking account of differences in sales volume constitutes discrimination); large licensee *D* demands a volume discount (0.5%) relative to *C* (citing *B*); etc.

87.   To the best of my knowledge, no court has held that a licensor's FRAND undertaking implies MFL treatment. If a licensee wants MFL treatment, that term must be made express in the license.

88.   Dratler, *supra* note 70 at §9.04 (holding that "where the license containing the [MFL] clause and later licenses differ significantly in terms or conditions, the most favored licensee cannot pick and choose among them, but must accept the good terms and conditions with the bad. If terms besides the royalty rate are changed, the favored licensee cannot receive the more favorable rate without also accepting any less favorable terms.").

89.   *See id.* While the need to adhere to the "entire package of terms and conditions" should be uncontroversial in principle, it may not be easy to enforce in practice. As the

D.   Other Structural Biases

1. The Alleged Upward Bias in Royalty Rates

It is, of course, not the job of an individual finder of fact to engage in systemic reform. Yet the supposed need for such reform is implicit in the static standardization narrative, which uniformly warns against supra-normal royalties resulting from the specter of hold-up.

While not explicitly arguing for systemic reform, individual litigants often hypothesize systemic bias when characterizing the data available to any given fact-finder.[90] Because of the systemic threat of hold-up, so goes the argument, actual license agreements are afflicted with an upward (that is, licensor-favoring) bias in the observed terms and conditions, despite the licensor's obligation – and the awareness of all prior licensees of that obligation – to be prepared to grant a license on FRAND terms and conditions. To the prospective licensee

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"downward non-discriminatory spiral" example shows, even the simplest contract term, such as a percentage-of-price royalty rate, can be recharacterized to mean something different to a subsequent licensee if (say) the subsequent licensee's price is different. Thus the benchmark contractual term, "1% of sales" is not usually accompanied by a parallel benchmark condition, "as long as you are selling at a price of $100," chiefly because such conditions restrict the ability of the licensee to alter its price, and force the parties to contract over contingencies that are irrelevant to their own agreement. But when the benchmark term "1% of sales" is applied to a subsequent licensee whose price is $200, the subsequent licensee can then argue that the benchmark contract did not contain any "price condition," so it would be wrong to read that condition into the benchmark contract when applying it to the subsequent licensee. Therefore, goes the argument, the "true" "effective rate" of the benchmark contract is $1 per unit, not 1% [= $2] per unit.

Similar facts that may have informed the parties' expectations and impacted the contractual rate, but that may not themselves have constituted an explicit condition of the benchmark license, could include: the volume of licensed sales; the location of sales; product attributes; complementary business relationships; a cross-license; the potential list is long. The absence of an explicit condition in the benchmark contract means that arbitrators should be especially cautious in applying the terms of a "comparable" agreement to a subsequent licensee, which has the incentive both to emphasize favorable contractual terms while ignoring unfavorable factual dissimilarities, and/or to emphasize factual similarities while ignoring unfavorable contractual terms.

Of course, licensors have the opposite incentives, and may make similarly selective arguments using "comparable" agreements. But FRAND licensors, unlike licensees, have already contracted not to discriminate against licensees; under contemporary readings of the FRAND undertaking, licensees are beneficiaries of that contract, but have not themselves contracted, with respect to discrimination or otherwise.

90. *See* Lemley & Shapiro, *supra* note 2; Joseph Kattan and Chris Wood, *Standard-Essential Patents and the Problem of Hold-Up*, (Dec. 19, 2013), https://ssrn.com/abstract=2370113 [https://perma.cc/C3QH-695L].

who wishes to avoid accepting the same terms as the existing licensees, this supposed bias contaminates all the prior contracts available to the fact-finder, no matter how consistent their terms. Thus, without explicitly demanding or justifying systemic reform, the prospective licensee indicts both "the system" and the negotiations conducted under it, discounting or eliminating the evidentiary value of the contracts produced in the instant proceedings. It follows that the only "fair" outcome is to implicitly repudiate these prior agreements, and to construct a brand-new set of "fair" terms and conditions.[91]

As an empirical matter, the proof of such bias would require the proof of some benchmark true value for a variable like the "FRAND rate," coupled with evidence that the observed value of the variable deviates systematically from that benchmark. For example, the proof of upward bias in royalty rates might be made via an economic model demonstrating that, absent the systemic threat of hold-up, industry royalty rates would be 10% lower. Such a proof would clearly establish the true royalty level, and measure the degree of bias observed relative to that level.

If offered, such proof would present the fact-finder with a difficult choice: whether to award "FRAND terms and conditions" that conform to prior agreements (on non-discrimination grounds) or whether to adjust the terms downward to remove the effects of bias evident in those prior agreements (on fairness grounds). But, however it might be resolved, each horn of that dilemma would have the advantage of having been grounded in fact and empirically supported.

The problem is that there is no such economic model of "hold-up bias." No economist has ever purported to measure the "percentage of upward bias" resulting from the residual "threat of hold-up" that ostensibly persists despite every licensor's universal FRAND commitment. The assertion of such bias is a fiction, conveniently unprovable, used to undermine the reliability of prior license agreements, permitting the licensee to seek fresh, "unbiased" terms from the fact-finder.

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91. *See generally* TCL Communication Technology Holdings, Ltd. v. Telefonaktiebolaget LM Ericsson , No. SAVC 14-00341 JVS, (C.D. Cal. 2017); In re Innovatio, 921 F.Supp.2d 903 (N.D. Ill. 2013).

2. Evidence of Systemic "Upward Bias"

One important reason why economists have not measured the "degree of upward bias" resulting from the "threat of hold-up" is that, despite widespread warnings from antitrust agencies and academics, economists have never observed, and courts have never found, an actual instance of hold-up by a telecommunications firm subject to a FRAND commitment.[92]

In International Trade Commission Inv. No. 337-TA-613 (Remand), the administrative law judge once again confronted the assertion that hold-up is a pervasive, systemic problem (an assertion made in prior investigations involving similar parties and facts).[93] The ALJ reviewed the evidence for this assertion exhaustively. For example:

> There is no evidence presented in this case that patent hold-up is a problem in the telecommunication industry. The Telecommunication Industry Association (TIA) in a June 11, 2011 response to the FTC's request for comments . . . stated that: "TIA has never received any complaints regarding such 'patent hold-up' and does not agree that 'patent holdup' is plaguing the information and telecommunications technology (ICT) standard development processes."[94]

> The FTC also made other comments that have been brought to the attention of the ALJ in this matter, such as "The FTC has recognized that the risk of patent '[h]old-up in the standard setting context can be particularly acute.'" Once more, however, the FTC provides no data that would demonstrate such holdup is occurring. Respondents also cite to the FTC comments in [ITC Inv. No.] 337-TA-745 which provided a similar concern that hold-up was a possibility if an exclusion order were to issue. Respondents did not note that the FTC took no position as to whether that had happened in the case, and have not found a hold-up in any case since.[95]

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92. Of course, courts have awarded royalty rates lower than those requested by a licensor. But disagreement over the correct rate is not *per se* evidence of hold-up, as that term is actually defined.

93. *See* Certain Wireless Devices With 3G Cap Capabilities, USITC Inv. No. 337-TA-800 (Jun. 28, 2013) (Public Version).

94. *See* Certain 3G Mobile Headsets, Inv. No. 337-TA-613, USITC Pub. 4145 (Apr. 2015) (Remand) at 63-64.

95. *See id.* at 60 (internal citations omitted).

In 337-TA-868, the ALJ found little reason to give weight to the agencies' comments, as they were speculative as to what could happen, and did not provide any evidence that holdup had occurred. There is now even more reason to give little weight to the concerns voiced by the FTC and DOJ/PTO in these letters.[96]

The ALJ went so far as to query Microsoft's economist, a published advocate of the "standard FRAND paradigm," on the empirical evidence for hold-up:

> The ALJ asked Dr. Shampine if he could cite even one solid example of a holdup resulting in a non-FRAND contract. Dr. Shampine replied, "We do not have a solid example of that occurring yet."[97]

Finally, the ALJ noted that Microsoft's assertion that hold-up was a systemic problem appeared to be opportunistic, being belied by its prior submission to the FTC:

> The notion that patent hold-up is a substantial problem that should be addressed by government action seems to stem from a largely theoretical analysis of the situation . . .
>
> We believe that there is an important difference between intentional or deceptive conduct in connection with patents that read on standards and routine bilateral disagreements over licensing terms for the use of patented technology.
>
> In the former context, there seems to be a dearth of examples of actual patent hold-up with regard to the essential patent claims reading on a standard. ***Microsoft has never been accused of patent hold-up in this regard, nor has it accused any other company of such behavior.***[98]

In short, the ALJ found that:

> In that time [since the FTC's initial inquiry into hold-up], the IP community has been vigilant and has kept a watchful eye on the ITC to ensure that patent holdup was not occurring. The result has been not a single case of holdup has been noted. Not one witness in this hearing was able to provide a single example of a holdup due to an exclusion order, or potential exclusion order. After watching for a holdup since 2011, we may be able to

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96.   *See id.* at 61.
97.   *See id.* at 45.
98*.   See id.* at 64-65 (quoting Letter from Microsoft to the Federal Trade Commission (June 14, 2011) (emphasis supplied in the Initial Determination).

consider whether the fact none has occurred allows us to discount the risk today.[99]

Despite this absence of evidence, claims that the "threat of hold-up" has distorted the terms observed in all prior licenses feature pervasively in "FRAND rate"-setting proceedings, even today.

3. Downward bias

As explained above, licensors confront the symmetric problem of "holdout" by prospective licensees. Holdout means delay, perhaps indefinitely, in the payment of royalties for standard-essential patents.

Unlike hold-up, which remains unobserved and for which no testable models or empirical measures exist, holdout has been defined and proved in court,[100] and can be modeled and measured relatively easily as a reduction in marginal cost.[101] While the mathematics are somewhat complex, the intuition is simple: by holding out, a firm obtains a cost advantage over a competitor who is licensed. That cost advantage translates into a competitive advantage: a larger market share for the unlicensed firm, and a smaller market share for the licensed firm. Given the standard relationship between price and cost, the holdout firm's cost advantage also translates into a price advantage, forcing the licensed firm to reduce its price as well. Thus, by increasing the holdout firm's market share, and reducing industry prices, holdout increases the share of unlicensed sales, and reduces both the number of units and the prices of licensed sales. Both effects reduce the royalties actually received by the licensor.

By taking market share from the licensed firm, the holdout firm introduces a third effect. A firm that chooses to license in the presence of holdout by a third party does so despite its recognition that it will be placed at a competitive disadvantage. Thus, as an inducement to enter into a license, the licensing firm will demand a lower royalty rate, to reduce the degree of that disadvantage. In other words, holdout by unlicensed firms puts downward pressure on the

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99.   *See id.* at 61.

100. *See id*. at 66 (''[The] evidence in this case supports a finding that [Microsoft] engaged in reverse holdup or holdout.'').

101.   Jonathan Putnam et al., Holdout Games (2018) (unpublished manuscript) (on file with author).

rates to which licensed firms will actually agree. Again, the result is to bias downwards the royalties actually received by the licensor.

Given the confidentiality of license agreements, it is difficult to measure precisely the extent of this bias on a global basis.[102] But in an individual arbitration, in which both the licensor's and the licensee's prior agreements have been admitted into evidence, the fact-finder may ask an important diagnostic question: for what share of the industry's standard-essential patents is the licensee currently paying royalties to the holders of SEPs? The answer to that question helps to identify the actual degree of downward bias in the licensee's cost and price, and thus the extent to which royalty payments based on the licensee's price under-compensate the licensor.

One may well ask why "the system" permits these distortions to occur. The simple answer is that SSOs permit implementers to implement a standard without any binding commitment to pay for patented technology embodied in the standard. The owners of the patented technology must instead identify each implementer and, if necessary, prove infringement.[103] This "catch me if you can" approach to an essential input is inherently inefficient and chaotic: one can imagine the results if airlines were permitted to fly without paying for jet fuel until "approached" by a fuel vendor. Of course, commercial contracts foreclose this possibility, either by demanding payment up front or by ensuring that claims for purchases paid in arrears are simply and universally enforceable.

Such systemic, procedural weaknesses must, of course, be addressed systemically. The putative setter of a "FRAND rate" cannot solve this problem unilaterally. For present purposes, the point is this: when confronted with unprovable claims of "upward bias" in the rates found in the licensor's existing licenses, arbitrators and other "FRAND rate"-setters should resist the temptation to engage in "systemic reform" on behalf of either party, while noting that, to the

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102. *See* Jonathan D. Putnam & Tim A. Williams, *The Smallest Salable Patent-Practicing Unit (SSPPU): Theory and Evidence* 55 (2016) (manuscript at Table 1), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2835617 [https://perma.cc/ZJK8-CD4A] (summarizing publicly available evidence on license agreements among some major telecom standard-essential patentees and licensees).

103. INTERIM REPORT OF THE UMTS IPR WORKING GROUP (1998) (articulating the rationale that the value of the ETSI IPR Policy is that the complex commercial issues of the details of licenses and of compensation therefore, are placed where they belong, at the center of bilateral negotiations between licensor and licensee).

extent that the licensee's price is biased downwards by holdout (against the licensor and/or third parties), the licensor will not be fully compensated even by a "FRAND rate" expressed as a percentage of that price.

V. SPILLOVER EFFECTS OF ARBITRATION PANEL DECISIONS

A. The Persistent Effects of Bad FRAND Decisions

It is a truism that arbitrators and other triers of fact often must confront sharply conflicting, and potentially misleading, expert testimony. There is no magic cure for this disease, though the preceding section can be read as a cautionary primer for the unwary. Arbitrators must do the best they can with the evidence placed before them.

For better or worse, the decisions of arbitral panels are usually neither precedential nor reviewable.[104] While these features of alternative dispute resolution solidify the harm from "bad," but persuasive, economic testimony, they also tend to limit the extent of that harm, by confining its effects to an individual arbitration.

FRAND arbitrations are different. Because a licensor has contracted not to discriminate among its licensees, a licensor whose benchmark FRAND terms and conditions have been decided by arbitration generally must submit the results of that benchmark award for consideration by subsequent arbitral panels, whose duty it is (on behalf of the licensor) not to discriminate with respect to the benchmark terms.[105]

The preceding section makes clear that the licensor's "non-discrimination" obligation can be exploited in economic testimony to create a "downward non-discriminatory spiral" – which is, of course, discriminatory. Thus, an arbitration panel that awards "FRAND rates"

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104. I intend this as an empirical observation, not as a statement of the law. The circumstances under which the decision (concerning FRAND terms and conditions, or in general) of an arbitral panel can or should be reviewed are outside the scope of this paper, and of economics in general.

105. These conclusions follow from the general nature of the licensor's FRAND obligation. The point is to illustrate the mechanism by which the decision and findings of one arbitral panel may be considered by a later panel. The observations of this section do not and cannot interpret or inform the evidentiary or procedural requirements of any individual arbitration, which are governed by contract.

derived from the (mis)interpretation of "effective rates" ends up perpetuating and extending this discriminatory outcome in subsequent arbitrations – its errors are not confined to its own award.

More generally, a licensor having multiple "benchmark" licenses, the terms of at least one of which have been formulated by an arbitration panel or other fact-finder, risks the possibility that the panel is persuaded by "bad" economic testimony. As a result, those fabricated terms will be inconsistent with the terms of the licensor's actual arm's-length agreements. In the absence of the licensor's FRAND-derived non-discrimination obligation, that inconsistency might be buried, along with other non-precedential and unreviewable arbitral awards. But given that obligation, subsequent arbitrators must confront this inconsistency, trying to determine what it means "not to discriminate" among one set of license terms, negotiated by the licensor, and another set of terms crafted by arbitrators, which are inconsistent with the first set (and perhaps among themselves).

While arbitrators (and humans in general) are well-known for their tendency to split the difference between these inconsistent positions, that tendency is, itself, discriminatory.[106] And of course, splitting the difference creates additional inconsistencies down the road for later arbitrators, who themselves must enforce the licensor's obligation not to discriminate among the (increasingly muddled) awards to its licensees.

Economists refer to economic effects that are not confined to the transaction in which they occur as "spillover effects."[107] For example, when an innovator publishes a patent application, the disclosed information "spills over" to other innovators, reducing the cost and/or increasing the quality of their own innovations, thus speeding the pace of technological change and increasing the intensity of subsequent competition. Such "positive spillovers" are valuable by-products of the patent system; like the incentive to invest in the initial

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106. One can well imagine the outcry if a claimant wage-earner – say, a member of a racial minority – should have received an additional $1 per hour in wages, instead of the 50 cents she actually received, because an arbitration panel "split the difference" between her true compensation and the $0 that her employer offered. Economic consequences aside, splitting the difference between the claimant's and respondent's positions perpetuates and rewards discrimination.

107. Wesley M. Cohen et al., R&D spillovers, patents and the incentives to innovate in Japan and the United States, 31 RES. POL'Y 1349, 1349-67 (2002).

innovation, such spillovers "promote the progress of science and the useful arts."

Inconsistencies among arbitral awards are an example of "negative spillovers." They hinder the recovery of investment returns, increase transaction costs, complicate dispute resolution, promote further disputes, and muddy subsequent decisions to invest in R&D. Such inconsistencies represent a systemic failing in a system that is supposed to "promote progress," not only through individual innovation, but through joint selection of the best among competing individual innovations. In short, inconsistency deprives everyone – including consumers – of some of the systemic gains from standardization that they might otherwise expect.

While "equal treatment under the law" is, of course, a bedrock principle of justice, and a principle that arbitrators and other triers of fact generally strive to enforce, such treatment is subject to the usual vagaries of human interpretation. Thus it is unsurprising, if regrettable, that arbitration awards differ across complex circumstances in which "non-discriminatory treatment" is difficult to define, never mind to ascertain.

All that said, if one is to interpret a licensor's FRAND undertaking as a contractual commitment to an SDO, of which standard implementers are third-party beneficiaries, then "non-discrimination" is not simply an abstract principle to be sought by neutral arbitrators, but a contractual obligation assumed by the licensor. This interpretation fundamentally alters the arbitrator's role, from "equal treatment" of the claimant and respondent to the enforcement of a contractual claim by one party against the other. When an arbitration panel fails to assess that claim accurately, it makes three errors: (1) it fails to enforce the SDO contract; (2) it introduces additional discrimination into subsequent comparisons also based on that contract; (3) it hinders *both* the parties before it, and subsequent parties that must grapple with its award, from receiving equal treatment under the law.[108]

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108. *See supra* Section IV.C.

B.   Examples

1. Within-licensor Inconsistency

Because arbitral awards are generally confidential, they are not subject to public comment or criticism. Thus, while the foregoing structural problems are both plausible and widespread, they are also difficult to illustrate with public data.

Since 2013, a number of courts have issued public decisions concerning the appropriate "FRAND rate" for a standard-essential patent portfolio.[109] As we have seen, setting a "FRAND rate" is itself a contractual misspecification, given a licensor's undertaking to be prepared to license on "FRAND terms and conditions." Be that as it may, such decisions and their bases are (at least partially) observable.

Perhaps the first such determination was made in a proceeding brought by Huawei against InterDigital, in Huawei's home town of Shenzhen, China. Huawei sought a determination that InterDigital had violated China's Anti-Monopoly Law by, among other things, abusing its "dominant position" and charging "excessive prices" for InterDigital's portfolio of SEPs.[110] The Shenzhen Court agreed, awarding to Huawei a "FRAND rate" of 0.019% of the handset price – far less than InterDigital had sought and, presumably, far less than the rates found in its many other licenses.[111] On appeal, the Guangdong Higher People's Court affirmed.

Although the decision of the Shenzhen court was sealed, InterDigital noted that the panel judges did not cite any factual basis

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109.   *See generally* Norman V. Siebrasse and Thomas F. Cotter, *Judicially Determined FRAND Royalties*, in Jose Contreras (ed.), THE CAMBRIDGE HANDBOOK OF TECHNICAL STANDARDIZATION LAW: COMPETITION, ANTITRUST, AND PATENTS (Cambridge: Cambridge University Press, 2017).

110.   Michael Han and Kexin Li, *Huawei v. InterDigital: China at the Crossroads of Antitrust and Intellectual Property, Competition and Innovation,* COMPETITION POL'Y, INT'L (2013), https://www.competitionpolicyinternational.com/assets/Uploads/AsiaNovember3.pdf [https://perma.cc/UMF6-A6HG].

111. *See   Form   10-K*,   INTERDIGITAL,   INC.   (Dec.   31,   2012), http://ir.interdigital.com/file//Index?KeyFile=392296770&Output=3&OSID=9 [https://perma.cc/6XEU-ATC7]. That the ruling was adverse can be inferred from InterDigital's appeal. That its result was materially different from InterDigital's anticipated licensing program can be inferred from InterDigital's public disclosure obligations to its shareholders.

for the royalty rate awarded.[112] Contemporaneous reporting further calls into question the court's commitment to enforcing the "non-discrimination" provision.[113] This peculiar circumstance may appear idiosyncratic. But it illustrates a more pervasive problem: the *rate* awarded by the trier of fact may be disclosed, but the *basis for the rate* may not be (because it depends on confidential or otherwise unpublished facts). Needless to say, to the extent that the published rate is sharply lower than the rest of a licensor's licenses and offers, for unobservable reasons, and that rate can be divorced from the agreement's (likewise unobservable) remaining terms and conditions, prospective licensees have the obvious incentive to demand the "same rate" on the grounds of "non-discrimination." Such "bad decisions" then follow a licensor around, like the undead, neither affirmed nor repudiated, until they can be distinguished for reasons of age or dissimilarity.

2. Between-licensor Inconsistency

Of course, "persistent bad decisions" are not persistent or bad simply because they are unexplained. Sometimes the explanation itself is inconsistent with "similar" decisions. And while there exist mechanisms, such as courts of appeal, for reconciling inconsistent legal decisions, those mechanisms do not exist for inconsistent factual inferences, or inconsistent decisions across sovereign jurisdictions. And they do not exist for inconsistent arbitral awards, at all.

Again to illustrate the potential for inconsistency, consider the court's reasoning in *TCL v. Ericsson*,[114] a recent decision that

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112. *See id.* at 136 ("The court further ruled that the royalties to be paid by Huawei for InterDigital's 2G, 3G and 4G essential Chinese patents under Chinese law should not exceed 0.019% of the actual sales price of each Huawei product, without explanation as to how it arrived at this calculation").

113. According to contemporaneous reporting, Qiu Yongqing, a senior judge who presided over the case at the Guangdong Higher People's Court, stated that:

> Huawei "used antitrust law as a weapon to counterattack" monopolization by multinationals in the technology sector, and that other Chinese companies should learn from Huawei. He went on to suggest that Chinese companies should utilize antitrust litigation to overcome technology barriers and thereby better develop themselves.

See Han, *supra* note 110, at 9.

114. TCL Communication Technology Holdings, Ltd. v. Telefonaktiebolaget LM Ericsson, No. SAVC 14-00341 JVS, 2013 WL 4150033, slip op. at 14ff (C.D. Cal. 2017)

purported to determine a "FRAND rate" for Ericsson's SEP portfolios. This decision adopted a so-called "top-down approach," under which the court determines a top-line aggregate industry royalty rate for all SEPs, then divides this aggregate rate among each of the firms holding SEPs, in proportion to the size of its portfolio (perhaps after further adjustments).

While the *TCL* decision may be faulted on many legal, conceptual and empirical grounds, for present purposes what matters is that the court took as its starting point Ericsson's 2008 belief that the aggregate industry royalty rate would be "6-8%" of the handset price for all LTE SEPs, and that Ericsson would own 20-25% of those SEPs.[115] The court reasoned that Ericsson's "statements were thus not a hope or prediction, but a pledge to the market that if the market adopted Ericsson's championed standard, the total aggregate royalties would be calculated as described above."[116] While Ericsson "point[ed] out that the publicly declared rates in 2010 from just nine SEP owners totaled 14.8% of the handset selling price," the court "discounted" these conflicting beliefs.[117] How Ericsson's beliefs could bind all others who contributed SEPs to "the market," or how third-party beliefs different from Ericsson's might be reconciled with Ericsson's so as to preserve "fairness" or "non-discrimination," the *TCL* court did not explain.

In any event, it is useful to compare the *TCL* court's assumption of a 6-8% "pledged" aggregate royalty rate with the comparable inference from the *Huawei v. InterDigital* award. InterDigital is generally considered one of the top 10 holders of patents disclosed as potentially essential to 2G, 3G and 4G standards, based on its quantity of patents. Leaving aside questions of portfolio quality and "actual essentiality,"[118] it is reasonable to assume (for the purposes of illustration) that InterDigital's portfolio constitutes at least approximately 1/25 (4%) of the industry total. That assumption

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115. *Id.* at 22.

116. *Id.* at 24.

117. *Id.*

118. In other work, I have estimated the quality of firm-level patent portfolios using generally accepted patent-citation methods. I have also estimated the firm-level probability that a patent disclosed as potentially essential is "actually essential," from multiple large-sample technical evaluations. While these measurements are empirically important to an actual FRAND-based valuation of an SEP portfolio, they are beyond the scope of this paper and do not detract from the present illustration.

implies that the aggregate industry royalty rate should be about 25 x 0.019% (0.475%), or a little less than one-half of one percent. But the *TCL* court's assumption (6-8%) is more than an order of magnitude (12 to 16 times) greater than the aggregate rate implied from the Shenzhen decision.

Note again that these "top line" conclusions apply to the same body of essential patents, covering the same devices, in the same industry. Under the "top-down method," this range means that a licensor's total compensation can vary from $10 million to $120-160 million, even assuming that both parties agree on the licensor's share of the "top line."

An arbitrator stepping into these waters could be forgiven for the inference that, when published trial court decisions as to what constitutes a "fair" and "reasonable" "FRAND rate" differ by this much, there is in fact no generally accepted "standard" by which to measure any such rate at all, and that the best course of action is to approach the problem with "fresh eyes." And so the cycle continues.

VI. CONCLUSION

As we observed at the outset, the demand for FRAND arbitrations springs from the demand for the resolution of disputes that have little public precedent: the neutral pricing of unspecified patents in large, uncertain, adversarial, private contracts. Given the asymmetric institutional and contractual obligations of the contracting parties, the demand for such resolutions is likely to increase, as SEP licensors can demand no more, and SEP licensees can do no worse, than "FRAND terms and conditions" – however defined. Those incentives often create unbridgeable, structural, differences: the prospective licensor must match its offer to its prior agreements, while the prospective licensee pays no penalty for insisting on terms superior to those agreements.

The determination of a "non-discriminatory" "FRAND rate" is complicated further by bad economic analysis, which is ubiquitous. This analysis takes two forms: the regulatory and academic advocacy of unproven and unmeasurable concepts like systemic hold-up, and "*ex ante* prices," which encourage *de novo* construction of a "FRAND rate"; and tactical errors by experts who advocate "effective rates" and other non-contractual parameters. Such testimony sometimes carries undeserved weight, as when arbitrators credit it over the terms

actually negotiated by actual market participants, who – most economists would agree – are better informed than any economist or arbitrator. Unfortunately, distinguishing good from bad testimony itself requires good economic training – a requirement that "economic experts" themselves often do not meet, never mind arbitrators.

The flames of demand for arbitration have been fanned by those who argue that the arbitration of a "FRAND rate" should be mandatory. If only – goes the argument – the parties faced "baseball arbitration" – under which the arbitrators choose one side's proposal, or the other's, without modification – the results would converge to the true "FRAND rate."[119] Of course, as we again have seen, the "FRAND rate" cannot be divorced from other "FRAND terms and conditions." And "FRAND terms and conditions" must, by definition, be non-discriminatory. But there is nothing about "baseball" proposals to ensure that the proposal proffered by *either* party is, in fact, non-discriminatory – even if it is otherwise "reasonable."

Into this structural quagmire the "FRAND rate"-setter is thrust.

Other than exposing some of the analytical and empirical errors that routinely enter into FRAND proceedings, I can recommend no failsafe procedure for the complex process of determining "FRAND terms and conditions." But one sure sign that a "FRAND rate"-setter has erred along the way is that she crafts a set of terms that will be uniformly chosen by the licensor's subsequent licensees in later proceedings. Such an agreement is said to "dominate" the licensor's existing agreements, and so must – by definition – discriminate relative to them. In other words, the arbitrator must subject her determination to the discipline of subsequent review, by courts or other arbitrators, with an eye to not creating "dominant" terms and thus avoiding the "downward 'non-discriminatory' spiral." When the "FRAND rate"-setter effects, rather than prevents, discrimination in favor of one party, she not only amplifies systemic weaknesses, but she needlessly (and permanently) hinders the licensor, future licensees, and future arbitrators, from reaching a just, consistent and non-discriminatory result. By definition, such arbitrated terms and conditions are not FRAND.

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119.   *See* Lemley & Shapiro, *supra* note 2, at 1144.