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Before the

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Library of Congress
Washington, D.C.

Digital Performance Right Sound Recordings and Ephemeral Recordings	:	Docket No. 2005-1 CRJ DTRA

Testimony of ADAM B. JAFFE

I. Introduction and Background

A. Qualifications

My name is Adam B. Jaffe. I am the Fred C. Hecht Professor in Economics and Dean of Arts and Sciences at Brandeis University in Waltham, Massachusetts. Before becoming the Dean of Arts and Sciences, I was the Chair of the Department of Economics. Prior to joining the Brandeis faculty in 1994, I was on the faculty of Harvard University. During academic year 1990-91, I took leave from Harvard to serve as Senior Staff Economist at the President's Council of Economic Advisers in Washington, D.C. At the Council, I had primary staff responsibility for science and technology policy, regulatory policy, and antitrust policy issues. I have served as a member of the Board of Editors of the *American Economic Review*, the leading American academic economics journal, as an Associate Editor of the *Rand Journal of*

Economics, and as a member of the Board of Editors of the *Journal of Industrial Economics.* I also serve as Co-organizer of the Innovation Policy the Economy Group at the National Bureau of Economic Research.

I have served as a consultant to a variety of businesses and government agencies on economic matters, including antitrust and competition issues, other regulatory issues, and the valuation of intellectual property, including music performance rights. I have served as a business consultant and testified on behalf of both owners and licensees on the subject of the valuation and pricing of intellectual property such as copyrights. I was also the Chair of the Brandeis Intellectual Property Policy Committee. I have filed expert testimony and been qualified as an economic expert in a variety of regulatory, judicial, and arbitration proceedings including the prior copyright arbitration proceedings relating to the statutory licenses at issue in this proceeding. At Brandeis and Harvard, I have taught graduate and undergraduate courses in microeconomics, industrial organization, and the economics of innovation and technological change. A true and accurate copy of my *curriculum vitae* is attached as Appendix A.

B. Background and Overview

In this proceeding, I have been asked by a group of webcasters[1] that are members of the Digital Media Association ("DiMA") including America Online, Inc. ("AOL"), Live365, Inc. ("Live365"), Microsoft, Inc. ("Microsoft"),

[1] I used the term "webcasters" to refer to Internet-only audio streaming businesses.

and Yahoo! Inc. ("Yahoo") to provide an economic analysis of issues related to valuation of the right of public performance of digital sound recordings under 17 U.S.C. § 114(f)(2)(B) and 17 U.S.C. § 112(a) for the period beginning on January 1, 2006, and ending on December 31, 2010. Section II provides a framework for my analysis. Section III examines benchmarks to use in fee-setting, and Section IV presents the fee model that I propose to be applicable for webcasters. Section V discusses other factors to consider when setting a reasonable fee, with particular attention to factors that are discussed in the statute.

II. Framework for Economic Analysis

A. Economic Justification for Compulsory License

From the perspective of economic analysis, the public policy motivation of a compulsory license/rate court framework for a sound recording performance royalty derives from the underlying structure of the market for the public performance right. The nature of broadcasting/webcasting is such that many or most broadcasters/webcasters need permission for public performance from many distinct original rightsholders in order to produce and broadcast/webcast the kind of programming that listeners find most enjoyable. Further, the identification of the particular sound recordings that are going to be broadcast/webcast at a point in time is often decided only shortly before the broadcast/webcast and consequent public performance of the recordings. These two factors combine to create a situation in which a

competitive market for public performance royalties for sound recordings may well be characterized by significant transactions costs, because negotiating agreements for the right of public performance with many different parties, often with uncertainty about what is going to be performed when and how often, would involve considerable time, inconvenience, and out-of-pocket costs.

In general, public policy seeks to encourage reliance on competitive markets, because such markets in most cases result in prices tied to costs, and prices that appropriately capture the value that buyers put on the good or service in question. But in a market in which a competitive structure would create large transactions costs, it may be advantageous to reduce those transactions costs by allowing centralized licensing of the right in question. Such centralized licensing permits broadcasters/webcasters to license the rights that they need from a single party, and removes from the licensee the burden of determining, on a performance-by-performance basis, how to acquire the necessary performance rights.

This centralization of licensing of the right of public performance comes at a cost: the loss of the benefits of competitive pricing for the right in question. A single party licensing performance rights on behalf of all or most owners of the rights in sound recordings will not license that right at a competitive price. Rather, such an entity can be expected to act as a monopolist, insisting on a fee for the performance license chosen to maximize

the revenues received. In the language of economics, such a centralized licensor has "market power," which is the ability to elevate the market price above the competitive level.

Indeed, the high transactions costs that were the justification for centralized license administration make it likely that the monopolist licensor will have considerable market power, i.e., will be able to succeed in setting a monopoly price that is considerably higher than the competitive level. The ability of a monopolist to elevate the price is limited only by the possibility that too high a price will induce some potential buyers to forgo purchasing. In the case of a public performance right, a broadcaster/webcaster has only three ways to avoid taking a license from a centralized licensor (in the absence of a compulsory license mechanism, which we will come to in a moment). First, the broadcaster/webcaster could try to get the necessary rights from the individual underlying rightsholders, bypassing the centralized license administrator (assuming that the right of the centralized administrator to license the underlying works is non-exclusive). But the high transactions costs make this option unlikely to be economically viable for most broadcasters/webcasters. Second, the broadcaster/webcasters could infringe the copyrights, but such an illegal option has to be thought of as either unavailable or very costly. Finally, the broadcaster/webcaster can choose not to broadcast/webcast at all, thereby forgoing the overall economic value of its business. Since all of these options are expensive for potential

licensees, they impose only a mild discipline on a centralized license administrator who is not subject to any external pricing constraint.

Thus in the absence of a more interventionary public policy, markets of this type must either be hindered by high transactions costs, or else be burdened by monopoly prices that are likely to be far in excess of competitive levels. Compulsory licensing, with the terms and conditions set by some kind of regulatory body, offers a solution to this dilemma. It offers the possibility of transaction cost-efficient centralized licensing, with terms and conditions of those licenses kept from monopolistic levels by the regulatory process. I now turn to the particular statutory framework created to implement this approach for particular digital public performances of sound recordings.

B. Willing Seller/Willing Buyer Marketplace

The statute specifies that the determined license rates and terms should be those "that most clearly represent the rates and terms that would have been negotiated in the marketplace between a willing buyer and a willing seller." The determination of the willing buyer/willing seller marketplace rate should be based on economic, competitive, and programming information, including certain specific criteria listed in the statute. I will discuss these specific criteria below. For the moment, I want to focus specifically on the economically appropriate interpretation of the willing buyer/willing seller marketplace test that the statute specifies for the rates and terms that should be established.

The discussion in the previous section suggests that, from an economic perspective, the compulsory licensing/regulatory regime that the statute establishes has a specific economic and public policy motivation. It is designed to resolve the dilemma created by the existence of licensing transactions costs, i.e., the desire to reduce such costs through centralization, combined with concern that such centralization creates market power. Compulsory licensing combined with recourse to a judicial authority can resolve this dilemma: a centralized licensing authority can be authorized to minimize transactions costs. An obligation to license under rates and terms subject to recourse to a regulatory review can then be used to ensure that the resulting rates and terms are kept to the competitive level.

Thus the economic and public policy interpretation of the compulsory licensing/rate court regime suggests that the willing buyer/willing seller marketplace test should be interpreted to mean that rates and terms should be set that would prevail in a market that is competitive while minimizing transactions costs. After all, if Congress had considered it acceptable for a "market" rate to be one at the level a monopolist would set at any price, it likely never would have created a compulsory license. If the law had simply created a right in the public performance of sound recordings by digital means, and left it entirely to users and rightsholders to negotiate terms, presumably they would have done so. The Recording Industry Association of America ("RIAA"), acting as a monopolist, would have insisted on a monopoly

level for the rates; it would license only licensees willing to pay at supra-competitive prices; and it would not have had any incentive to grant licenses to users unwilling to pay that monopoly rate. In the end, we would have had some number of "willing" buyers paying at above-competitive market rates and a willing seller engaged in a "marketplace" transaction; and we would not have had to adjudicate to get that result.[2] It simply makes no sense to think that Congress created a compulsory license with the objective of reproducing the kinds of supra-competitive transactions made between monopolistic "willing sellers" and circumscribed "willing buyers" that would occur absent a compulsory license constraint. An interpretation of the willing buyer/willing seller marketplace rule that did not ensure rates and terms at the competitive level would therefore be inconsistent with the statute's economic and policy motivation.

The problem of mitigation of market power is handled in an analogous manner with respect to the licensing of the performance rights in musical works. In that arena, the major collective licensing organizations, the American Society of Composers, Authors and Publishers ("ASCAP") and

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[2] In fact, the previous CARP and the Librarian dismissed this interpretation. The Librarian endorsed the CARP's rejection of 25 of 26 agreements reached by the RIAA as not representative of transactions between a willing buyer and a willing seller. "...the Panel did not accept the 26 voluntary agreements at face value. ...Ultimately, it gave little weight to 25 of the 26 agreements for these reasons and because the record demonstrated that the rates in these licenses reflect above-marketplace rates due to the superior bargaining position of RIAA or the licensee's immediate need for a license, due to unique circumstances." Library of Congress, Copyright Office 37 CFR Part 261, Docket No. 2000-9 CARP DTRA1&2, Determination of Reasonable Rates and Terms for the Digital Performance of Sound Recordings and Ephemeral Recordings, *Federal Register*, Volume 67, No 130, July 8, 2002 ("Librarian Decision 2002"), at 45248.

Broadcast Music, Inc. ("BMI"), operate subject to Consent Decrees with the Department of Justice that resolved antitrust litigation against them. Under these Decrees, both organizations are constrained to offer licenses under specified terms, and at "reasonable" rates. The Federal Courts that administer the Decrees play a role analogous to the Copyright Royalty Board ("CRB") (and previous arbitration panels), reviewing the rates demanded by the organizations if a voluntary agreement cannot be reached. The Courts have interpreted the term "reasonable" to mean competitive market rates, precisely to prevent the exercise of what otherwise would be the market power of ASCAP and BMI.

Thus, another way to state the conclusion that the statute requires that rates and terms be kept to the competitive level would be that the Courts should determine "reasonable" rates and terms. Indeed, the legislative history related to Section 114(f)(2)(B) observes that the CRB will "determine reasonable rates and terms" and that this process is "[c]onsistent with existing law."[3] I will, therefore, for convenience, use the term "reasonable" to describe the rates and terms to be set by the CRB, by which I mean rates and terms consistent with those that would prevail in a competitive market.[4]

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[3] H. Conf. Rep. No 105-796, 105th Congress, 2d Sess. At 86 (1998).

[4] The Librarian agreed with this interpretation, noting that the CARP interprets the statutory standard as " 'the rates to which, absent special circumstances, most willing buyers and willing sellers would agree' *in a competitive marketplace.*" Librarian's 2002 Decision at 45244-45245. (emphasis added) See also, the very title of the Final Rule issued by the Library of Congress entitled "Determination of *Reasonable Rates and Terms* for the Digital Performance of Sound Recordings and Ephemeral Recordings," 37 CFR at 45240

C. Using Benchmarks to Determine Reasonable Fee

As a matter of economic analysis, it is typically not possible to determine the reasonable or competitive fee level on the basis of the fundamental underlying costs and benefits. This fundamental indeterminacy of a reasonable fee is common with respect to the valuation of intellectual property, because the "cost" of providing that property to an additional user is essentially zero, while the "value" of the property to the user is inextricably interwoven with other components of the user's product or service. For these reasons, it is common—both in litigation and in voluntary commercial transactions—for royalties for the use of copyrights, patents, and other intellectual property to be established by reference to "comparables" or "benchmarks" rather than derived from explicit cost or value considerations.

For any possible benchmark, one must first determine whether the rate it presents can be presumed reasonable, since a benchmark that is itself unreasonable cannot be used to derive a reasonable rate. Second, one must determine the most economically appropriate metric or fee base to be used in translating the reasonable fee in the benchmark context into a corresponding fee in the current context. Finally, one must consider how much weight to give to each benchmark, based on its overall economic significance and the relative reliability of any adjustments that may be necessary in each case.

(emphasis added); Librarian's 2002 Decision at 45241 ("CARP Proceeding to Set Reasonable Rates and Terms")

There will always be a range of buyer "valuations" corresponding to potential users with varying perspectives, such as different ways of using the rights, differing perceptions of the importance to outside market and financial observers of having secured the rights, different levels of risk aversion, and differing access to financial resources. Despite the transactions cost issues discussed above, there may be one or a handful of observable transactions that have occurred between the monopolist licensor and individual licensees who, for various reasons, may be willing to transact at monopoly prices.[5] But in a competitive market, the market price will not be determined by the valuation of specific users who, for particular reasons, are willing to transact at high prices. Thus, even if such individual deals are in some sense between a willing buyer and a willing seller, they are not indicative of the reasonable, competitive market rate. We are therefore unlikely to have available to us demonstrably reasonable benchmark rates from transactions involving the rights and parties covered by Section 114(f)(2)(B).

Given this situation, we have two choices. We can rely on limited benchmarks that are not likely to be reasonable, or we can turn to the rates that are paid by webcasters for a closely related right to provide evidence on the competitive rate level. The problem with the first approach is that it is very difficult to know what adjustments would be necessary to an

[5] See discussion *supra* at footnote 2 and citation to the circumstances found to have existed in the previous CARP.

unreasonable rate in order to render it reasonable. In contrast, by starting with a tested rate in the same context, considering a range of possible adjustments, and being conservative as necessary, we can produce a much more reliable indicator of the reasonable rate in the case at hand.

III. The Benchmark Fee

A. The 2001 Decision Setting Sound Recording Performance Royalty Is Not an Appropriate Benchmark

The rates that webcasters pay SoundExchange through the end of 2005 were set by the Librarian of Congress in 2002. After the Copyright Arbitration Royalty Panel ("CARP" or "Panel") issued its report, the Librarian of Congress reviewed the decision by the Panel in the case regarding the setting of a reasonable rate for the public performance of sound recordings for the 1998-2000 time period and the 2001-2002 time period.[6] In the decision, the Librarian set a rate of $0.0007 per performance for the public performance of all Internet transmissions.[7] In large part, this decision was based on the experience of a single customer, even though the Panel recognized the customers could have a range of valuations.[8]

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[6] Report of the Copyright Arbitration Royalty Panel, In the Matter of Rate Setting for Digital Performance Right in Sound Recordings and Ephemeral Recordings, February 20, 2002 ("2002 Report of the CARP"). Librarian Decision 2002 at 45240-45276.

[7] Librarian Decision 2002 at 45255.

[8] 2002 Report of the CARP at 24, 74.

Since 2002, webcasters have been paying SoundExchange at rates that were set in the first CARP on this issue.[9] Although this rate is for the same right that is at issue here, this decision is not an appropriate starting point for the following reasons:

It is based on a contract for a single user with special circumstances. Although the CARP recognized that there could be a range of valuations for digital sound recording performances, it ignored this in implementing a rate to be paid by the webcasting industry. This is not consistent with the outcome in a competitive market. The statute does not say that the CARP should set rates and terms that were in fact negotiated by a single entity in the marketplace, but instead rates that *would have been* negotiated in the marketplace, taking into account certain factors. In 2001, the Panel interpreted the statute's reference to rates that "most clearly represent the rates...that would have been negotiated in the marketplace" as the rates "to which, absent special circumstances, most willing buyers and willing sellers would agree."[10] The Yahoo contract that was the basis for the 2001 decision was indeed negotiated under such distinctive conditions. Yahoo was willing to agree to a royalty rate insisted on by the RIAA that was

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[9] Note that, in 2003, as part of the extension of the 2002 decision, the webcasters and the RIAA/SoundExchange agreed to the level of royalties for Internet radio services to pay to recording companies for 2003 and 2004. See "DiMA and RIAA Submit Joint Royalty Proposal," DiMA press release, April 3, 2003. Library of Congress, Copyright Office 37 CFR Parts 262 and 263, Docket No. 2002-1 CARP DTRA3 and 2001-2 CARP DTNSRA, Digital Performance Right in Sound Recordings and Ephemeral Recordings, *Federal Register*, Volume 69, No 25, February 6, 2004 ("Librarian Decision 2004"), at 5693-5702.

[10] 2002 Report of the CARP at 25; Librarian Decision 2002 at 45244-45245.

significantly in excess of the competitive level because Yahoo calculated that the cost of litigation to achieve such a competitive royalty would be greater than the savings from paying a reasonable rate and having to spend litigation fees to get it.[11] The ASCAP and BMI rate courts have similarly rejected previously negotiated agreements as benchmarks where such agreements reflect the exercise of significant market power and/or the alleged benchmarks were negotiated under distinctive conditions rendering them inappropriate as the basis for reasonable rates.

Yahoo valued the certainty that entering into a license with the RIAA granted with respect to its ability to budget and to manage the potential risk from an adverse judgment. Yahoo was also less concerned about the level of fees since it was entitled to pass through license fees to its broadcast.com clients.[12] In addition, by entering into a voluntary agreement, it was able to eliminate some uncertainties about whether radio retransmissions on broadcast.com met the criteria to qualify for a statutory license.

The cost of litigation was large. The value of a CARP-determined statutory license as a substitute for a voluntary deal is inherently limited by the legal costs that parties expect would accompany that option. Put simply, the cost of relying on the statutory license would be the expected reasonable rate plus litigation costs. Thus, if the RIAA-proposed voluntary deal

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[11] Testimony of David Mandelbrot, Yahoo! Inc., In the Matter of Digital Performance Right in Sound Recording and Ephemeral Recordings, Docket No. 2000-9 CARP DTRA1&2, October 15, 2001 ("2001 Mandelbrot Testimony") at pages 3-4.

[12] *Id.*

exceeded a reasonable rate, but exceeded it by less than the expected litigation costs, licensees would still agree to the proposed unreasonable rate. This message implies that, even if Yahoo believed that the reasonable rate was zero, they would still be better off accepting the RIAA's "proposed numbers," because litigating to get the reasonable rate would cost even more.[13] It appears undisputed that this was a central feature surrounding the Yahoo-RIAA license.

Yahoo's agreement was negotiated against the backdrop that Yahoo's business model primarily involved broadcast simulcasting. Yahoo's voluntary negotiated agreement from August 2000 included two rates that were applicable after a lump sum payment: [REDACTED; RESTRICTED] Yahoo stated that its primary concern was the overall cost of the deal, not the specific rate for different types of transmissions.[14]

At the time the agreement was negotiated and the time of the previous CARP, over 90% of Yahoo's business was the rebroadcast of radio signals. In 1999, Yahoo acquired broadcast.com, a service whose business included streaming audio for several hundred over-the-air radio stations. At the time that Yahoo negotiated its license with the RIAA in 2000, it was willing to negotiate a higher rate for the Internet-only transmission in return for a

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[13] See 2001 Mandelbrot Testimony at pages 3-4; Rebuttal Testimony of Adam B. Jaffe, In the Matter of Digital Performance Right in Sound Recordings and Ephemeral Recordings, Docket No 2000-9 CARP DTRA1&2, October 4, 2001, ("Jaffe Rebuttal Testimony"), at 62; and Librarian Decision 2002 at 45255.

[14] 2001 Mandelbrot Testimony at 4.

lower rate on the radio retransmission, since most of its payments would be for radio retransmissions.[15] "The Panel found the rate for the IO [Internet-only] transmissions to be artificially high and, conversely, the rates for the RR [radio retransmission] to be artificially low. For this reason, it made a downward adjustment to the IO rates and an upward adjustment to the RR rates."[16]

Yahoo's business model has changed entirely since the initial RIAA-Yahoo deal. Yahoo's activities under the webcasting statutory license now consist almost entirely of Internet-only streaming.[17] Indeed, it is telling that Yahoo did not renew its license with the RIAA in 2001 precisely because it deemed the rates to be unreasonable.[18] Thus, whatever may be said of the (questionable) relevance of the 2000 Yahoo-RIAA agreement in relation to the prior CARP term, it plainly is of little or no value as a benchmark for the 2006 – 2010 license term.

If the voluntary agreement rate turned out to be too high as compared with the statutory rate, Yahoo would have been able to avail itself of the lower rate. To the extent that arbitration resulted in

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[15] 2001 Mandelbrot Testimony at 4.

[16] The Librarian recognized that "the real agreement between Yahoo! and RIAA was for a single, unitary rate for the digital performance of a sound recording...rates, which the Panel found were artificially high (for IO transmissions) and low (for RR)." Librarian Decision 2002 at 45252. See also Librarian Decision 2002 at 45253.

[17] See Testimony of Robert Roback, Yahoo! Inc. ("Roback Testimony").

[18] See Roback Testimony.

lower fees going forward, Yahoo would have been able to take advantage of the lower rate after the expiration of the agreement.

Sound recording royalties are out of line with musical works royalties. As discussed below, the rates that were approved by the Librarian set royalties for the sound recording copyright significantly higher than the royalties for the musical work. Each of the DiMA companies participating in this proceeding has paid significantly more to SoundExchange to license performing rights for sound recordings than to the Performing Rights Organizations ("PROs") to license the performance rights for musical works.

In conclusion, in setting industry-wide fees, the CARP and the Librarian did not account for the unique facts and circumstances surrounding the Yahoo-RIAA agreement, yet the Panel explicitly relied on terms and conditions of the Yahoo-RIAA agreement as a benchmark for industry rates. A single specific agreement based upon the special situation of an individual company whose business model, at the time the agreement was struck, was not representative of the business models of Internet webcasters, was an unreliable benchmark to serve as the basis for fees for all webcasters and is even less appropriate as a benchmark year later, after Yahoo itself elected not to renew it. By not taking these factors into consideration, the Panel and the Librarian misapplied the Yahoo agreement to set rates for the entire industry that are excessive.

B. 2004 Extension Is Not an Appropriate Benchmark

For the period covering 2003 - 2005, DiMA and the RIAA agreed to an industry-wide extension of the royalty rates set for the public performance of sound recordings.[19] The Librarian's final decision regarding rates from 1998 to 2002 was issued in July of 2002, near the end of the period covered by the license. Parties subject to that agreement were, at the end of 2002, still litigating some of the issues decided and were not ready to mount a costly legal battle to challenge the fees. Additionally, parties were awaiting a decision from Congress on whether it would reform the process by which royalties for all statutory copyright licenses were determined. Because of these circumstances, the parties further extended the royalty structure set forth by the Librarian in the 2002 agreement through the end of 2005 as they were awaiting a decision from Congress.[20] These extensions served as temporary fixes to avoid large legal bills so shortly after the conclusion of the previous arbitration, and allowed the industry to develop experience under the new rates. These extensions suffer from the same deficiencies as described above, cannot be presumed to be reasonable, and therefore cannot be relied on as a benchmark for fee-setting.

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[19] Librarian Decision 2004 at 5693-5702; See also footnote 20 *infra* and accompanying text.

[20] See Testimony of Jonathan Potter, Executive Director of the Digital Media Association, and "DiMA, Recording Industry and Artists Propose Internet Radio Royalty Extension," DiMA press release, August 31, 2004. Ultimately, Congress passed the Copyright Royalty and Distribution Reform Act of 2004 on November 30, 2004, and created the Copyright Royalty Board. As part of that change, the Act provided that rates in place on December 31, 2004, would stay in place through 2005 or until such a date as the Copyright Royalty Judges determine.

C. Performance Right Benchmark

Given that there are not benchmarks for the performance of sound recordings under the webcasting statutory license, the best available starting point for a reasonable fee for the public performance of sound recordings is the fee paid for the closely related public performance of musical works. The musical work and the sound recording are inextricably intertwined in producing the value of the public performance. In most cases, to make the performances, a user needs both rights. There are no incremental costs in either case of making the underlying intellectual property available for public performance. Thus, there is no reason to expect that the outcome of the negotiations would be higher for one or the other.

Use of the royalty rate for performances of the musical work to infer a reasonable royalty rate for the sound recording is not without precedent: the CARP determined fees for the public performance of sound recordings by subscription digital cable radio services under the Digital Performance Rights in Sound Recording Act of 1995 based on the royalty rate for musical works performances.[21]

The available theoretical and empirical evidence suggests that the fee paid by users for the performance of a musical work provides an upper bound to the value of the performance of a sound recording. Thus, setting the

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[21] See discussion in Librarian of Congress, Final Rule and Order, 63 Fed. Reg at 25394, 25404 (May 8, 1998); Report of the Copyright Arbitration Royalty Panel, Docket No. 96-5 CARP DSTRA, November 28, 1997, at para. 197-202.

royalty rate for sound recordings at a level that is equal to the royalty rate for musical works would produce a reasonable rate for sound recordings.

1. Implications of the willing buyer/willing seller model

To understand the implications of the willing buyer/willing seller model on the relationship between the musical work and sound recording, we must analyze how both buyers and sellers would approach a negotiation over blanket licenses for digital performance rights. In both cases, we can analyze how the "willing buyer" (a licensee) and a "willing seller" (a licensor) would approach these negotiations. If both the buyers and the sellers would be approaching these negotiations from economic positions that are similar with respect to musical works and sound recordings, then there is no economic basis for concluding that the market values for the two rights would differ.

The buyer side of the negotiations: The value that buyers put on the right of the public performance of both the musical works and the sound recordings is derived from the value that they expect to realize by making the public performance of music. Each of these rights is needed for a public performance, and in order for the buyers' valuations of the two rights to differ, it would have to be the case that there is some distinction in the manner or extent to which each right facilitates such performances. But no such differences exist because a buyer needs both rights to make a public performance. This means that each right is worthless to the buyers unless they also procure the other right. Once both sets of rights are procured, they

each contribute symmetrically to the generation of the value of the public performance. Because of this symmetry and mutual necessity, the buyers' "willingness to pay" for each right will be derived in the same way from the value that buyers expect to derive from making the performances. Hence, there is no difference in a buyer's demand or willingness to pay for the musical work and the sound recording. Going into negotiations over either right, buyers will be in the same position.

Note that this is important for the analysis of a blanket license for a substantial portion of the repertoire, which is the case we are discussing. For a *specific* sound recording or musical work, the user may value one over the other. For example, if I were considering broadcasting Frank Sinatra singing "As Time Goes By," I might want a Sinatra performance, or I might want the particular song. Depending on my preference, I may be willing to substitute another recording of the song, or choose to substitute another Sinatra sound recording. But this analysis applies to specific sound recording/musical work combinations. While buyers may have varying relative willingness to pay for a *specific* sound recording or musical work, at the *blanket license* level, I do not have the choice to substitute a different sound recording or a different musical work. Whatever I broadcast, it must contain both a musical work

and a sound recording.[22] As long as I am negotiating for a blanket right to each, they are both essential and I would value them equally.

The seller side of the negotiation: The sellers of each right are not the same, but each comes to the negotiation from a similar position. In each case, the costs of producing the underlying intellectual property are "sunk," by which economists mean that the investments have already been made, and the decision or action currently being considered (i.e., to license or not the right of performance of existing sound recordings via the narrowly specified performances at issue in this proceeding) does not affect the cost of producing the intellectual property. Further, in each case, owners of the sound recordings and publishing rights look to recover these costs (including compensation for risks incurred) from revenues earned in other markets. In the case of sound recording rightsholders, the costs are covered by CD sales,[23] and, increasingly, other digital media such as downloads. In the case of musical work rightsholders, the costs are covered by a combination of

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[22] This statement is not strictly true because of some slight differences in copyright treatment of sound recordings and musical works. On the musical works side, there are some compositions that are in the public domain. On the sound recording side, pre-1972 recordings do not carry the right to control the public performance. But overall this is a small set of performances.

[23] The vast majority of the record industry's $12 billion in sales comes from the sales of CDs. See 2004 RIAA Year-end Statistics, U.S. Manufacturers Unit Shipments and Value (www.riaa.com/news/newsletter/pdf/2004yearEndStats.pdf).

mechanical royalties and over-the-air performance royalties.[24] The digital performance royalty is incremental to this substantial revenue in both cases.

Finally, there is no incremental cost imposed on either the musical work or the sound recording licensor by virtue of making the underlying intellectual property available for digital performance. In such a situation, economics tells us that both the sound recording and musical work rightsholders would approach this negotiation for the performance rights in the same way: they would recognize that there is no incremental cost to supply this market and would simply hold out for as much of the user's overall performance value as they could get.

The RIAA has long argued that sound recording royalties should be higher than musical works royalties because their investment in the original creation of the work is greater. If this argument is made in the context of the licensing of the right at issue (as distinct from the original market for the sale of the sound recordings themselves), it amounts to a claim that the market for digital performance rights should be affected by sunk costs. It is one of the most basic tenets of economics that rational decisionmakers should not allow sunk costs to affect forward-looking decisions. One can imagine that an owner of sound recordings would *like* to recover more revenue from a

[24] In 2001, publishers were paid $318 million in royalties for radio performances and $553 million in mechanical royalties. See National Music Publishers' Association, Inc., and the Harry Fox Agency, Inc., *NMPA International Survey of Music Publishing Revenues*, 12th Edition, at 8. In 2004, radio stations still earned substantial royalties from radio; radio stations had blanket licenses with ASCAP and BMI for over $350 million. See www.radiomlc.com/ascap_faq.html and www.radiomlc.com/faq.html.

webcaster license, in recognition of the cost of creating that sound recording originally, or in the hopes that this greater revenue will help to finance the creation of the *next* sound recording to be created. But it is irrational to bring this wish to the negotiating table for webcaster licenses, because neither the cost of the original investment, nor the cost of the new investment, will be affected by whether or not this particular license is issued.

This is not to say that real business decisionmakers do not sometimes make the mistake of allowing their decisions to be affected by sunk costs. They do, just as real decisionmakers make all kinds of mistakes, every day. But the standard for this proceeding is that of an overall market test, not the peculiarities of particular decisionmakers. And in competitive markets, the market outcomes are determined, at least in the long run, by the actions of rational decisionmakers. Thus it is simply inconsistent with economic analysis of how competitive markets work to suggest that a competitive royalty for webcaster performances of sound recordings would be affected by the original cost of creating sound recordings, or by the expected cost of creating new sound recordings in the future.[25]

This analysis does not in any way suggest that the zero incremental cost of the right being transferred would lead to a zero royalty. Quite the

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[25] Theoretically, it would be possible for the royalty for webcaster performances of sound recordings to be affected by the expected cost of making *future* sound recordings, but for this to be true it would have to be the case that the licensing of sound recording performances to the webcasters somehow necessitates the creation of additional sound recordings without corresponding additional revenue. I do not see any economically reasonable mechanism by which this would occur.

contrary, intellectual property with zero incremental cost is routinely licensed at positive royalty rates. With respect to both musical works and sound recordings, we have a potential licensee with some maximum willingness to pay that is derived from the value of the buyer of the performances, and we have a seller with a minimum willingness to accept a zero royalty. The economics of bargaining suggests that the parties will reach agreement at some point in between. Economics cannot tell us where in the interval between the buyer's maximum royalty and the seller's minimum royalty the parties will come out. It will depend on the negotiating skills of the parties. This, combined with the going-in valuation for each party, determines the outcome. Because the going-in valuations on both the buyer's and seller's sides are the same with respect to musical works and sound recordings, there is no reason to expect that the outcomes would be higher for one or the other. *Thus, I would expect that, from the perspective of a willing buyer and a willing seller, the musical works royalty would be equivalent to the sound recording royalty.*

Actually, there is one factor that suggests that, in general, the owners of sound recording performance rights may well be willing to license at *lower* rates than the owners of musical works. In both cases, the willingness of the licensor to agree to a low royalty is increased by any expectation of *promotional value* associated with the licensed performance. And because sound recording owners derive more revenue from every CD sold than do the

owners of the attached musical works, the value of such promotion is greater for the sound recording owner than it is for the musical works owner. Indeed, there is a long history in the U.S. of practices related to "payola," whereby owners of sound recordings have bribed or otherwise tried to induce broadcasters to play their recordings. There has never been, to my knowledge, evidence of owners of musical work copyrights engaging in such practices. This asymmetry between sound recording owners and musical works owners in their incentive to induce promotion of their works by webcasters, combined with the perfect symmetry that exists in the value of the two rights to the webcaster licensee, suggests that, if anything, competitive market royalties for sound recordings are likely to be *lower* than those of musical works.

2. Marketplace Evidence of Equality of Sound Recording and Musical Work Performances

In order to test this framework, I looked for situations where a buyer was negotiating for musical work and sound recording rights at the same time, for the same use, in actual competitive markets. The U.S. does not generally recognize the right of public performance in sound recordings, so it is not possible to make a direct comparison of musical work and sound recording performance royalties in a competitive market. A circumstance, however, where the market does value the rights related to sound recordings and musical rights is when a producer of a motion picture or television program wishes to incorporate a pre-existing sound recording into a newly

created audio-visual program. In such a situation, the producer must secure the right to reproduce both the sound recording itself and the underlying musical work.

The economic incentives underlying the determination of these royalties correspond to those described above: the buyer needs both the musical work and sound recording rights, and the licensors of both the sound recording and the musical work rights face zero incremental cost in conveying the rights in question. Further, the markets in which these rights are purchased are competitive because the payments for each song are negotiated separately, and producers have access to multiple sound recordings and musical works. The economic analysis of the incentive underlying the bargaining for the acquisition of these rights is exactly the same as the analysis above, except that it occurs on a song-by-song basis, rather than on a blanket basis.

An analysis of movie and television data relating to the use of previously existing sound recordings and musical works in movies and television programming demonstrates that competitive markets value sound recording performances no more highly than musical work performances. In order to include a pre-existing sound recording in a motion picture or television episode, two rights must be obtained: the master use right (covering use of a particular sound recording) and the synchronization ("synch") right (covering use of the musical work). A particular producer

may care about getting a specific performer or may care about getting a specific song, so that for any single song, the payment for the sound recording may be greater or lesser than the payment for the musical work. On average, however, if my analysis of the underlying economics applies, the two should be approximately equal.

In 2001, I obtained data on the level of fees paid for sound recording and musical works fees from three major Hollywood studios and analyzed the relative valuation of musical works and sound recordings based on approximately [REDACTED; RESTRICTED].[26] The data, covering movies and television shows, overwhelmingly show that musical works and sound recordings are valued approximately equally in the market.[27]

Figure 1A and Figure 1B reproduce the results of my analysis of motion pictures and television programs respectively. From my review of the data, it is clear that, although there are individual instances where master use fees are higher than synch fees (and vice versa), the two fees are identical in the majority of cases. Further, an examination of the contracts struck between the studios and the rightsholders reveals that guaranteed parity of musical work and sound recording fees is often written into the use agreement contracts in the form of Most Favored Nation ("MFN") clauses.

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[26] See Jaffe Rebuttal Testimony at 20-24.

[27] In order to ensure that reported fees represent competitive market conditions, I excluded transactions that were not at "arm's-length," where other services or rights were bundled with those of interest, where the sound recording and musical works rights were owned by the same party, and where the songs were written or re-recorded for the production.

MFNs were sought by holders of both the musical work copyright and the sound recording copyright, ensuring that if the holder of one of the copyrights negotiated a higher fee from the licensee-studio, the other fee would be adjusted to that level. Indeed, overall, the payments for sound recordings are slightly less than those of musical works, with the sound recording payments [REDACTED; RESTRICTED]. But the overall tendency towards equality is unmistakable.[28]

The evidence from 2001 is overwhelming that the value of the sound recording right is no greater than the value of the musical work right. As discussed by witness Karyn Ulman based on her extensive experience in the music licensing marketplace, I am advised that the licensing patterns I observed in 2001, as summarized above, have not changed in any tangible respect. Thus there is no reason to believe that the results of my 2001 analysis would be different if conducted with more recent data.

IV. The Fee Model

A. Structure of Fee Proposal

Because of varied business models of the webcasters, I propose that the webcaster be able to elect one of the following ways of paying fees to SoundExchange: i) a fee per performance, ii) a fee per Aggregate Tuning Hours ("ATH"), or iii) a fee as a percentage of revenue associated with the

[28] Performing this analysis after excluding transactions that include a MFN clause produces similar results.

streaming website.[29] This fee structure is consistent with the current options that are available to subscription services under the statutory license.

Structuring fees on a per-performance basis or on a per-ATH basis are both metrics that vary with the scale of activity by the webcaster. When fees are tied to the volume of performances or use of bandwidth, the level of the fee will vary by licensees and over time as the number of performances increases or decreases. Generally speaking, this scaling of the royalty paid to the extent of use of the licensed matter is intuitively appealing and is a common feature of intellectual property licenses in certain contexts.

Revenue is a less exact proxy for the scale of activity, because the revenue that a licensee derives, even from its music-related activities, can be influenced by a variety of factors that have nothing to do with music. Nonetheless, licensing intellectual property with royalties calculated as a percentage of revenue is also a common practice in competitive markets, so long as the revenue base used for royalty calculation is carefully defined to correspond as closely as possible to the intrinsic value of the licensed property, and to exclude revenue that is likely to be driven by other factors.

B. Performing Rights Royalties

In order to determine the appropriate fee, I look to the payments made on the basis of agreements that the webcasters have in place with ASCAP, BMI,

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[29] See Testimony of J. Donald Fancher, Deloitte and Touche ("Fancher Testimony") for definition of revenue associated with streaming.

and SESAC, Inc. ("SESAC"), the performing rights organizations that represent the rightsholders of the copyright embodied in the musical work. The model presented here compares favorably to the PRO-based model advanced by the webcasters in the previous CARP, which was keyed off of PRO fees by *other* parties (*i.e.*, broadcast radio stations) for performances of works in a *different medium* (*i.e.*, broadcast radio) which required the making of calculation assumptions, also not applicable here. The model set forth below is based on the PRO fees paid by the *same* webcasters litigating herein for the *same* Internet radio performances for which they are obligated to pay SoundExchange under the statutory license at issue. As discussed above, I believe that the musical work fee represents an upper bound on a reasonable fee for a sound recording. It is clear that the fees that are currently paid under the statutory license for the digital performance of sound recordings are far out of line with the fees that are paid for the rights to the musical works embedded in the same performances.

Percent-of-Revenue Royalty Rate: The standard "form" license offered by ASCAP and BMI to license musical works on Internet sites has several options based on a percent of revenue. These licenses cover the musical works performance rights for the same performances for which this proceeding will determine the rate for the sound recording performance right (plus some additional performances not covered by this proceeding). Licensees have the option of paying 1.75% to BMI and 1.85% to ASCAP of

gross revenue that includes a broad definition of Internet-related revenue. A "pure play" webcasting site would pay under such a formula, paying the PROs approximately 3.8% of its revenue once SESAC is factored in.

For multi-media operations, ASCAP and BMI offer a second option to pay a slightly higher percentage of a more circumscribed definition of revenue. As discussed by witness J. Donald Fancher of Deloitte and Touche, the definition of revenue that is associated with this option is designed to capture only music area revenue, that is, those revenues directly associated with the performance of music. It is my understanding that the RIAA has already adopted a definition that is largely consistent with this definition for subscription services operating under the statutory license. Services that avail themselves of this option pay a higher royalty rate (approximately 5.5% aggregated over all three PROs) over a smaller music-only-related revenue base. ASCAP's license under this option calls for payments of 2.76% of revenue directly attributable to music performances, while BMI's license under this option calls for payments of 2.5% of such revenues. The standard Internet license offered by SESAC is not revenue-based; however, SESAC historically has accounted for a small share of the overall royalty picture and [REDACTED; RESTRICTED]. Hence the overall musical works royalty is

approximately 5.5% of revenue limited to a revenue base directly attributable to music performances.[30]

This percentage-of-revenue figure reflects what the PROs ask for in a standard contract. Many webcasters, however, negotiate individual agreements with the PROs under terms that are presumably more favorable to them than the standard-form rate. Further, the 5.5% reflects a royalty payment at a higher rate than the 3.8% of revenue rate that is available to a pure play webcaster. Finally, ASCAP also provides a third option: If revenue that is associated specifically with ASCAP music can be identified, services can pay ASCAP at 5.1% of revenue for those performances. If this same rate were to be applied to performances associated with the other PROs, it implies an overall rate for all performances of 5.1% of revenue specifically associated with music performances. Given these various options, the aggregate 5.5% of revenue rate based on music-related revenue represents an upper bound for a reasonable royalty as a percentage of revenue.

The webcasters have agreements with the PROs to license the musical works from ASCAP, BMI, and SESAC. Some of these licenses are structured as percentage-of-revenue licenses that fall within the range of 3.8% to 5.5% of revenue for payments to ASCAP, BMI, and SESAC.[31] For those webcasters

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[30] The 5.5% figure is calculated as 2.76% for ASCAP plus 2.5% for BMI plus .24% for SESAC. SESAC royalty rate as a percent of revenue is calculated based on webcaster payments to SESAC as a percentage of total PRO payments. This calculation is also consistent with a SESAC license [REDACTED; RESTRICTED]

[31] [REDACTED; RESTRICTED]

that are paying these PROs on a basis other than a percentage of revenue, I am unable to determine the implicit percentage of revenue actually being paid, because these webcasters have had no reason to maintain the records necessary to calculate revenue on the appropriate basis.[32] Of course, since all webcasters have available the option of licensing the musical works at the percentage-of-revenue rates offered in the standard-form PRO licenses, we can infer that any webcasters that negotiated licenses on some other basis are likely to be paying less than the standard-form percentage of revenue. Hence it is clear that the 3.8% to 5.5% of revenue range is, overall, an overstatement of the rates paid by webcasters to license the performances of musical works.

This range compares to a 10.9% of revenue option available to subscription services under the extension of the 2001 agreement by the CARP. Because the definitions of revenue subject to fee are not precisely the same, these percentages may not be exactly comparable. It is clear, however, that both are intended conceptually to measure revenue that is associated only with music service activities covered by the underlying licenses. Thus, even with an allowance for a possibly inexact match in revenue definitions, it is clear that the Internet royalty rate for musical works is much lower than the rate for sound recordings.

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[32] See Roback Testimony and Testimony of Christine Winston, AOL, Inc ("Winston Testimony"). I also understand that on a going-forward basis, the webcasting services will be able to track webcasting revenue in accordance with the definition proposed by Mr. Fancher. *Id.*

Per-Performance or Per-ATH: We can also examine the fees paid by AOL, Live365, MSN, and Yahoo to ASCAP, BMI, and SESAC for the performances of the musical works that are associated with the sound recordings that are the subject of this proceeding and translate those fees into a per-ATH or per-performance measure of the fee. Each of the webcasters has agreements with the PROs to license the public performance of musical works from ASCAP, BMI, and SESAC. These webcasters provided the fees that are associated with the license of the musical works at issue in this proceeding.[33] The summary of PRO fees for calendar year 2004 allows a concrete and direct measure of market rates for digital performance of musical works that covers the overwhelming majority of broadcasts at issue in this proceeding.

Because we can calculate the ATH and/or the number of performances associated with the webcasting business, these licenses fees can be converted into both a per-performance and a per-ATH rate. Figure 2 summarizes the range of fees and the average fees on a per-performance and a per-ATH basis for the webcasters involved in this proceeding.

PRO licenses for some of the services cover all audio and video streaming as well as other uses of music on the website, whereas the payments for sound recordings that are covered under this proceeding cover only audio

[33] See Winston Testimony, Roback Testimony, Testimony of David Porter, Live365, Inc., Testimony of Don Holtzinger, Microsoft, Inc.

streaming. For example, the PRO licenses of Yahoo and AOL cover their music video streaming activities, while these activities are not subject to the sound recording statutory license. To compare the musical work fees paid to the PROs with the rights being licensed here, I thus exclude from the PRO fees the percentage of total ATH that are *not* covered under the sound recording statutory license. For example, as explained in the Roback testimony, if 25% of a webcaster's streaming hours (ATH) represented music video streaming hours and 75% represented statutory license radio streaming, then I would use 75% of the webcaster's PRO fees for purposes of the comparisons described above.

[REDACTED; RESTRICTED]. The SoundExchange rates for the sound recordings are thus significantly higher than the rates paid to the musical work rightsholders for the same performances, whether measured on the basis of percentage of revenue, per-ATH or per-performance.

Figure 2 does show significant variation in the fees paid by different webcasters, whether on a per-performance, per-ATH, or percentage-of-revenue basis. Such variations occur in most real markets and are particularly unsurprising in the dynamic context of the Internet. At the same time, there is not a single licensee who currently pays as much for musical works as for sound recordings, regardless of which metric of valuation we examine. Hence the evidence is overwhelming and unambiguous that the current SoundExchange rate is too high.

As is always the case for an honest depiction of "reasonable fees" based on observable benchmarks, there is some fee range, rather than any specific number, that can be characterized as reasonable given the available data. An obvious reference point for a reasonable rate in this proceeding is the overall industry average royalty rate paid for musical works. [REDACTED; RESTRICTED] But given the available data, there is a zone of reasonableness around these average rates. [REDACTED; RESTRICTED]. Note that even the upper limits of these reasonable ranges are, in all cases, significantly below the current SoundExchange rates. Further, as discussed below, there are multiple factors suggesting that these musical work-derived rates are, in fact, *overstatements* of a reasonable rate for sound recordings. Hence it is clear that significant reductions in the SoundExchange royalties are necessary to render them reasonable.

V. Other Factors to Consider in Setting a Reasonable Fee

Based on the theoretical discussion and empirical evidence considered above, there does not appear to be any basis from an economic perspective for saying that the "true" value of a sound recording is greater than the value of a musical work. Of course, one can identify particular musical works that have a value that transcends any particular sound recording as well as sound recordings whose value transcends that of the musical work being rendered.

There are several reasons why the musical work benchmark derived from fees paid to ASCAP, BMI, and SESAC is likely to be an upper limit on

the reasonable sound recording royalty being determined as part of this proceeding, both as a general proposition within the competitive markets framework and on the basis of the specific statutory criteria enumerated in Section 114(f)(2)(B):

- The ASCAP, BMI, and SESAC fees that compose the benchmark are above the reasonable rate because of the market power of those entities.
- The promotional value of public performances or "airplay" by webcasters is significantly greater to the owners of sound recording copyrights than it is to the owners of the musical works copyrights.
- The technological contribution of the webcasters is significantly greater than that of the rightsholders.
- The capital investment of the webcasters is significant, and there is significant doubt regarding their ability to recoup these investments with reasonable returns.
- The risks currently faced by the webcasters far exceed the risks faced by the rightsholders.
- The costs borne by the webcasters, relative to their likely revenues during the license period, are much greater than the costs of the rightsholders relative to their overall revenues.
- The legal right conveyed by Section 114(f)(2)(B) is limited in ways that diminish that right's value, at least for some webcasters.

I will now discuss each of these points in more detail.

Market Power of ASCAP, BMI, and SESAC: The organizations that offer blanket performance licenses for musical works have market power because many broadcasters have no realistic alternative to the licenses they offer. In the case of ASCAP, this is disciplined by the possibility of appeal to

the ASCAP Rate Court, but this means only that the ASCAP fee cannot exceed the reasonable level by more than an amount that corresponds to the cost and risk of a licensee initiating a Rate Court proceeding. The situation with BMI is similar. As to SESAC, there is no rate court option. Although SESAC provides only a small portion of the fees (because of the small repertoire that it controls), it is likely that this fee component is above the competitive level because broadcasters' only alternative to a SESAC license is to try to purge their programming of SESAC music. In effect, SESAC is large enough to make it difficult to broadcast/webcast without it, while small enough to apparently avoid Justice Department scrutiny.

Promotional Value: Whatever the underlying or fundamental value of a musical work or sound recording, the competitive market royalty of a public performance of each would be affected by the promotional value created by that performance. From an economic perspective, we would expect that the *total consideration* provided by a licensee to the owner of a performance right would approximately correspond to the "value" of a performance of the underlying musical work or sound recording. But "consideration" does not come only in the form of the royalty paid. Typically, a broadcast/webcast public performance also provides benefit to the owner of the underlying musical work or sound recording by stimulating sales of albums and other fixed media containing the work being performed.

Though the RIAA is concerned that the Internet radio stations are too specialized and are therefore substitutes for CDs, webcasters function in a manner similar to over-the-air radio by playing a list of songs with each listener having only limited ability to influence the songs that he or she hears. In order to obtain a statutory license under the DMCA, webcasters must abide by certain restrictions for their non-subscription services. The webcasters cannot publish an advance schedule or announce the title of a sound recording prior to transmission.[34] Additionally, webcasters cannot play more than three songs from one album in a three-hour timeframe, and they cannot play more than two songs from one album consecutively.[35] Webcasters have invested in proprietary software that restricts the number of songs from the same artist or album that are played in a particular time period.[36] Internet listeners are unable to request a specific song and they are unable to play a given artist, album, or song on demand.[37] Finally, some of the non-subscription services covered by the statutory license offer a lower-quality sound recording than one would obtain with the purchase of a CD.[38] These limitations on sound recordings make streaming a poor substitute for purchasing albums or downloads.

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[34] 17 U.S.C. § 114(d)(2)(C)(ii).

[35] 17 U.S.C. § 114(d)(2)(C)(i). The statute details limitations that restrict the number of songs from the same artists or albums that can be played.

[36] See Roback Testimony and Winston Testimony.

[37] See Roback Testimony.

[38] See Roback Testimony.

Record companies have long recognized the promotional value inherent in traditional, over-the-air radio play and have worked with terrestrial radio stations to promote new artists and new albums. Recently, record labels increasingly have started working with Internet radio stations, in the same manner that they have worked with over-the-air broadcasters for years, in order to reach the large Internet listening audience. The audience for Internet radio has grown significantly and the weekly audience is nearly 20 million people.[39] The record labels are now "servicing" webcasters like they do traditional broadcasters. The record labels provide large webcasters with advance copies of new songs to play before the release of a CD in order to promote new releases or artists.[40] Internet radio play of new artists has created large increases in record sales. For example, AOL Breakers and artist-specific promotions on LAUNCHcast have been shown to have significant promotional value to the artists featured on these programs.[41] Webcasters have invested in capturing this promotional value by adding "Buy Now" features to their radio players and displaying the song title, album, and artist while the song plays so that listeners have the information necessary to purchase music they like.[42]

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[39] Arbitron/Edison Media Research, *Internet and Multimedia 2005: The On-Demand Media Consumer*, at 5.

[40] See Roback Testimony and Testimony of Jack Isquith, AOL, Inc. ("Isquith Testimony").

[41] See Testimony of Jay Frank, Yahoo!, Inc. ("Frank Testimony") and Isquith Testimony.

[42] See Frank Testimony, Isquith Testimony, and Testimony of N. Mark Lam, Live365, Inc. ("Lam Testimony").

Additionally, play on Internet radio is now treated similarly to play on over-the-air radio in tracking sales of records. Broadcast Data Systems ("BDS"), which provides data to *Billboard* for its radio play charts, has started to monitor radio plays on some of the large webcasters; and MediaBase, another monitoring company, has plans to gather data on Internet radio play.[43] Record companies can track when and how often their sound recordings are played on the Internet. The fact that BDS and MediaBase monitor streaming also allows record labels access to more detailed demographic information (gathered by webcasters) on the people who have heard their songs.[44] It is expected that BDS and MediaBase will incorporate Internet play into their radio airplay charts and webcasting will soon have the same impact on radio airplay charts as over-the-air radio.[45]

Through servicing and radio airplay monitoring, Internet radio stations are being treated similarly to terrestrial radio stations by the record labels. As a result of promoting artists and songs on Internet radio, record labels have been able to positively impact their record sales. Therefore, the compensation to record companies for the sound recordings that are streamed through the Internet is not just the royalty payment that is made by the webcasters. Rather, the total compensation to the record companies is the royalty fee plus the additional profit they receive from the increased record

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[43] See Frank Testimony.

[44] See Frank Testimony.

[45] See Frank Testimony.

sales. Traditional, over-the air broadcasters do not pay a royalty for sound recordings because radio play is considered to have significant promotional value, and the owners of the copyrights in sound recordings receive a significant part of their income from the sale of albums. Although the owners of the copyrights in musical works do derive some income from the sale of albums (through mechanical royalties), this income is typically much less than the incremental profit of record companies. Therefore, setting a fee for the performance of a sound recording equal to the fee for the musical work actually provides to the owners of the sound recording (the record labels) greater compensation than to the owners of the musical work.

Relative contribution of technology, capital investment, cost, and risk: The contributions of the sound recording owners are contained in the sound recordings themselves; there is no additional contribution on their part in connection with the webcasting of public performances. On the other hand, the contribution of the webcasters is significant. Webcasters are incurring substantial business risks and costs, whereas the sound recording owners bear no risk associated with their licensing of sound recordings for webcast performances, and most of their costs are sunk.

Webcasters spend millions on equipment, R&D, programming, music purchase, bandwidth, encoding, and personnel. The webcasters have invested in developing software applications and databases in order to be

able to deliver their services to a large audience.[46] Webcasters also continue to spend significant amounts of money on ongoing operational costs, including bandwidth and licensing fees.[47] The webcasters are responsible for all the costs associated with playing music over the Internet. The owners of the sound recording rights have, in many cases, already recovered their costs through the sale of albums. The licensees are incurring costs relative to the revenue that they are collecting that are far greater than the costs borne by the record companies, relative to their revenues.

The licensees face significant risk of overall business failure. In fact, the number of webcasters has decreased significantly after the fee decision from the previous CARP.[48] One of the factors that contributed to this decline was that the rates set in 2001 were too high for many webcasters and they had to stop business operations. Additionally, the webcasters in this proceeding have indicated that they are now limiting the amount of time that listeners can use their non-subscription radio services.[49] The webcasters have considered discontinuing their non-subscription services altogether because

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[46] Testimony of Robert D. Roback, In the Matter of Digital Performance Right in Sound Recordings and Ephemeral Recordings, Docket No 2000-9 CARP DTRA1&2, October 4, 2001, ¶28.

[47] Testimony of Fred Mcintyre, In the Matter of Digital Performance Right in Sound Recordings and Ephemeral Recordings, Docket No 2000-9 CARP DTRA1&2, April 11, 2001, ¶13. See Lam Testimony.

[48] It is worth noting that after the rates were set under the previous CARP ruling there was a decrease in the total number of Internet radio stations. From 2001 to 2002, the number of stations declined by over 30%. See "BRS Media's Web-Radio reports a steep decline in the number of stations webcasting," BRS Media, Inc., press release, September 12, 2002.

[49] See Roback Testimony, Winston Testimony, and Lam Testimony.

of the significant costs associated with this line of business.[50] In contrast, the record companies face risks in the creation and promotion of any single record, but they can spread these risks over their portfolio of recordings. Even at the rates requested by the RIAA, webcaster royalties will be a trivial fraction of record company revenues, so the level of such rates cannot conceivably have more than a trivial impact on the investment recovery of the record companies.

Legal right is more limited: The legal rights granted by Section 114(f)(2)(B) are restricted by the requirements of the statute, whereas the musical performance licenses contain few, if any, such restrictions. The rights conveyed under Section 114 bear certain specific limitations that do not apply to the musical work performance rights whose value has been calculated above.[51] From an economic perspective, a legal right that is restricted in various ways is likely to be less valuable, all else equal, than one that is not.

Conclusion: This qualitative evidence points to the fact that the fee for the sound recording should be less than for the musical work. Hence, the proposal to base the fee in this proceeding on the corresponding rates for musical works is conservative from the perspective of the licensees. This means that the upper end of the range of observed musical works royalties

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[50] See Roback Testimony, Winston Testimony, and Lam Testimony.

[51] 17 U.S.C. § 114(d)(2)(C).

described above are not, in fact, likely to correspond to reasonable rates for the sound recording royalty. In order to establish reasonable royalties in this proceeding, the CRB should set sound recording royalty rates towards the middle or lower end of the observed range of musical work performance royalties for webcasters.

Apendix A

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Dean of Arts and Sciences, 2003 - present
Fred C. Hecht Professor in Economics, 2003 - present
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Chair, Brandeis Intellectual Property Policy Committee, 2001 - 2003
Member, University Advisory Council, 2001 - present

Harvard University, Faculty of Arts and Sciences, Cambridge, MA

Associate Professor of Economics, 1989 - 1994
Assistant Professor of Economics, 1985 - 1989
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President's Council of Economic Advisers, Washington, DC
Senior Staff Economist, 1990 - 1991

EDUCATION

Harvard University, Cambridge, MA
Ph.D. in Economics, 1985
Dissertation: "Quantifying the Effects of Technological Opportunity and Research Spillovers in Industrial Innovation"

Massachusetts Institute of Technology, Cambridge, MA
S.M. in Technology and Policy, 1978
Thesis: "Regulating Chemicals: Product and Process Technology as a Determinant of the Compliance Response"
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The Burlington Northern and Santa Fe Railway Company (Steptoe & Johnson, Washington, DC)
Before the American Arbitration Association, Tucson Electric Power Company, Claimant, v. Burlington Northern and Santa Fe Railway Company, Respondent. Direct testimony in an arbitration proceeding concerning a coal transportation contract, January 26, 2001; Deposition, February 9, 2001.

Cheminova A/S (Beveridge & Diamond, Washington, DC)
Before the American Arbitration Association, In The Matter of Arbitration Between Cheminova A/S, Claimant and Griffin LLC, Respondent, Docket No. 23 171 00020 99. Direct Oral Testimony in a data compensation case concerning a pesticide, December 7, 2000; Oral Rebuttal Testimony, December 9, 2000.

Music Choice (Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, Washington, DC)
In the United States District Court, Southern District of New York, United States of America against Broadcast Music, Inc., et ano., In the Matter of the Application of Music Choice, et al., Applicants, for the Determination of Reasonable License Fees. Affidavit, July 28, 2000; Expert Report, January 26, 2001; Supplemental Expert Report, March 9, 2001; Deposition, March 28, 2001; Affidavit, April 9, 2001; Oral Testimony, May 29, 2001.

Wilson-Cook Medical Incorporated (Brinks Hofer Gilson & Lione, Chicago)
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Owens-Corning (Forman, Perry, Watkins, Krutz & Tardy, Jackson, MS)
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Ellis Simon, *et al.* (Brown, Rudnick, Freed & Gesmer, Boston)
In the United States District Court, Eastern District of New York, Ellis Simon, et al., v. Philip Morris Incorporated, et al., CV-99-1988, First Amended Class Action Complaint. Testimony on behalf of the plaintiffs in tobacco litigation; Expert Disclosure Statement, December 20, 1999; Deposition, February 28, 2000; Affidavit, April 13, 2000.

Vastar Resources, Inc.

Before the United States of America, Department of the Interior, Minerals Management Service, Further Supplementary Proposed Rule for Establishing Oil Value for Royalty Due on Federal Leases, Affidavit, January 31, 2000. *Before the United States of America, Department of the Interior, Minerals Management Service, Vastar Resources, Inc.'s Request for a Binding Value Determination on Transportation Allowances*, Affidavit April 4, 2000. Testimony on behalf of Vastar Resources, Inc., on issues related to the appropriateness and reasonableness of various methodologies that may be employed for the purpose of determining transportation allowances to be used for royalty payments from federal leases.

Pharmaceutical Research and Manufacturers of America

Prepared research report entitled "Consequences of Pharmaceutical Price Controls on Innovation" (with Catherine Moore), May 1999.

PacifiCorp (Stoel Rives, Portland, OR)

Before the Public Utility Commission of Oregon, UE 102, In the Matter of the Application of Portland General Electric Company for Approval of the Customer Choice Plan. Testimony on behalf of PacifiCorp regarding the company's eligibility to participate in an auction of generation assets, April 26, 1999.

Turner Broadcasting System, Inc., et al. (Weil, Gotshal & Manges, New York)

In the United States District Court, Southern District of New York, United States of America against American Society of Composers, Authors, and Publishers, In the Matter of the Application of Turner Broadcasting System, Inc., et al., Applicants, For the Determination of Reasonable License Fees, CIV. NO. 13-95 (WCC), Expert Report prepared on behalf of the applicants in litigation about music licensing fees, April 16, 1999; Deposition, July 26-27, 1999; Rebuttal Expert Report, December 16, 1999; Deposition, March 3, 2000.

The American Chemical Society

Developed and evaluated a number of approaches to pricing the web editions of ACS's publications. Modeled the performance of the various pricing plans to assess their ability to protect ACS's publications revenue as web editions replace paper. (1999)

Copyright Clearance Center, Inc. (Weil, Gotshal & Manges, New York, NY)

Primary consultant on statistical and economic matters since 1985; designed and implemented CCC's initial statistical methodology for pricing corporate photocopy licenses; recently assisted the Rightsholders Committee of the Board of Directors in designing a new market-based approach to valuation of copyright licenses and distribution of the resulting royalties. (ongoing)

Procter & Gamble, Inc. (Torys, Toronto)

In the Matter Between Unilever PLC. and Lever Brothers Limited, Plaintiffs, and Procter & Gamble, Inc., and the Procter & Gamble Company, Defendants, Court File No. T-2534-85,

Expert Report prepared on behalf of the defendants in patent dispute, January 11, 1999; Reply Report, January 29, 1999; Oral Testimony, December 6-7, 1999.

Ironworkers Local Union No. 17 Insurance Fund and its Trustees (Milberg, Weiss, Bershad, Hynes & Lerach, San Diego)

Ironworkers Local Union No. 17 Insurance Fund and its Trustees, et al., vs. Philip Morris, Inc., et al. (Ohio), Expert Report prepared on behalf of the plaintiffs in tobacco litigation, November 6, 1998; Supplemental Report, December 17, 1998; Deposition, January 11 and 21, 1999; Oral Testimony, February 23, 1999.

State of Wisconsin (Habush, Habush, Davis & Rottier, Milwaukee)

The State of Wisconsin v. Philip Morris, et al. Prepared Expert Witness Report on behalf of the plaintiffs in tobacco litigation, November 1, 1998.

Trans-Alaska Pipeline (Steptoe & Johnson, Washington, DC)

In the Matter of the Correct Calculation and Use of Acceptable Input Data to Calculate the 1997, 1998, 1999, 2000 and 2001 Tariff Rates for the Intrastate Transportation of Petroleum over the Trans Alaska Pipeline System Filed by Amerada Hess Pipeline Corporation; Arco Transportation Alaska, Inc.; BP Pipelines (Alaska) Inc.; Exxon Pipeline Company; Mobil Alaska Pipeline Company; Phillips Alaska Pipeline Corporation; Unocal Pipeline Company; Phillips Transportation Alaska, Inc.; and Williams Alaska Pipeline Company, LLC, and the Protest by Tesoro Alaska Petroleum Company of the 1997 and 1999 Tariff Rates, Before the Regulatory Commission of Alaska, Docket No. P-97-4. Prepared Direct Testimony evaluating whether the TAPS Intrastate Settlement and the ratemaking methodology it established produce tariff rates that are just and reasonable, October 8, 1998; Second Prepared Direct Testimony, July 12, 2000; Prepared Rebuttal Testimony, February 26, 2001; Oral Testimony, April 10-13, 2001.

Commonwealth of Massachusetts (Brown, Rudnick, Freed & Gesmer, Boston)

The Commonwealth of Massachusetts vs. Philip Morris Incorporated, et al., Civil Action Number 95-7378. Prepared Expert Disclosure Report on behalf of the plaintiffs in tobacco litigation, June 16, 1998; Affidavit in Opposition to Defendants' Motions for Summary Judgement, October 30, 1998.

CBS (Weil, Gotshal & Manges, New York)

CBS Inc. v. American Society of Composers, Authors & Publishers, New York State Supreme Court, New York County. Prepared Expert Report regarding timing of payments under ASCAP agreements, August 11, 1997; Deposition, June 12. 1998; Addendum to Prepared Expert Report, December 1, 1998; Supplemental Deposition, January 28, 1999.

Public Broadcasting System, National Public Radio, and the Corporation for Public Broadcasting (Weil, Gotshal & Manges, New York)

Prepared testimony regarding royalties for copyrighted musical compositions, *In the Matter of the Rates for Noncommercial Educational Broadcasting Compulsory License, Before the*

Copyright Arbitration Royalty Panels, Docket No. 96-6, CARP NCBRA, 1997. Written Testimony, April 1, 1998; Oral Testimony, April 1-2, 1998; Rebuttal Testimony, April 15, 1998; Oral Rebuttal Testimony, May 7, 1998.

State of Minnesota (Robins, Kaplan, Miller & Ciresi, Minneapolis)

The State of Minnesota and Blue Cross and Blue Shield of Minnesota vs. Philip Morris Incorporated, et al., Court File No. C1-94-8565. Prepared Expert Witness Report on behalf of the plaintiffs in antitrust litigation involving allegations of collusive conspiracy, May 29, 1997; Deposition, June 26-27, 1997; Oral Trial Testimony, March 18-23, 1998.

PacifiCorp (Stoel Rives, Portland, OR)

PacifiCorp, Electric Restructuring Transition Plan, Before the Montana Public Service Commission, Docket No. D97.7.91. Prepared Prefiled Rebuttal Testimony evaluating testimony regarding market power in the generation of electricity in Montana, February 24, 1998; Prefiled Surrebuttal Testimony, July 21, 1998.

PacifiCorp (Stoel Rives, Salt Lake City)

United States District Court for the District of Idaho, Snake River Valley Electric Association v. PacifiCorp, Case No. CV 96-0308-E-BLW. Testimony analyzing allegations of anticompetitive behavior and evaluating market power. Expert Witness Statement, October 17, 1997; Affidavit, February 27, 1998; Expert Report, January 22, 2002; Supplement to the Expert Report, April 8, 2002; Revised Supplement to the Expert Report, August 15, 2002; Affidavit, September 18, 2002; Oral Testimony, September 20, 2002, October 15, 2002.

Trans-Alaska Pipeline (Steptoe & Johnson, Washington, DC)

Prepared Affidavit and Rebuttal Affidavit evaluating the competitive impact of the Amended and Restated Capacity Settlement Agreement, *Exxon Pipeline Co., et al., Application of TAPS Carriers for Approval of Amended and Restated Capacity Settlement Agreement, Before the Federal Energy Regulatory Commission, Docket No. OR96-1-000, et al.* (1997)

The Burlington Northern and Santa Fe Railway Company (Steptoe & Johnson, Washington, DC)

Prepared Verified Statement regarding market power in transporting coal, *In the Matter of Western Fuels Service Corporation v. The Burlington Northern and Santa Fe Railway Company, Before the Surface Transportation Board, STB Docket No. 41987.* (1997)

PacifiCorp (Stoel Rives, Portland, OR)

Assisted in FTC pre-merger Hart-Scott-Rodino review; prepared *Economic Analysis of Alleged Vertical Market Power Consequences of Merger of PacifiCorp and Peabody Coal.* (1997)

Subaru of New England, Inc. (Todd & Weld, Boston)

Subaru of New England, Inc., vs. Subaru of Wakefield, Inc., Civil Action No. 96-01475-A, Commonwealth of Massachusetts, Norfolk County, Superior Court Department. Prepared Affidavit regarding appropriate methodology for assessing competitive impact of dealer relocation, November 20, 1996.

Public Service Company of New Hampshire

Direct testimony before the State of New Hampshire Public Utilities Commission, Docket No. DR 96-150, Electric Industry Restructuring, with Joseph P. Kalt, October 18, 1996.

Pro Se Testimony

United States of America before the Federal Energy Regulatory Commission "Alternatives to Traditional Cost-of-Service Ratemaking for Natural Gas Pipelines, Regulation of Negotiated Transportation Services of Natural Gas Pipelines," Docket No. RM-96-7-000. Comments of Adam B. Jaffe and Joseph P. Kalt, May 30, 1996.

Massachusetts Technology Collaborative

Prepared a study assessing the effects of reductions in federally funded R&D on the Massachusetts economy. (1995-96)

Federal Trade Commission

Asked by Commission staff to prepare testimony for Hart-Scott-Rodino preliminary injunction hearing regarding anticompetitive impact of a proposed acquisition. (1995)

GAF Corporation, *et al.* (Hannoch Weisman, Roseland, NJ)

Joseph Rossi, et al., vs. Standard Roofing, et al., Civil Action No. 92-5377, United States District Court, District of New Jersey. Prepared Expert Witness Report on behalf of six defendants in antitrust litigation involving conspiracy and monopolization claims. (1995)

Connecticut Light and Power Company

Before the Connecticut Department of Public Utility Control, Investigation into Restructuring of the Electric Industry, Docket No. 94-12-13. Submitted Written and Oral Hearing Testimony. (1995)

New England X-Ray & Electronics Inc. (Kushner & Sanders, Wellesley, MA)

New England X-Ray & Electronics Inc. vs. Robert T. Kennedy, Inc., et al., Commonwealth of Massachusetts, Number 88-5532. Presented damages study and jury trial testimony regarding breach of contract. (1990-95)

Florida Gas Transmission Company

Before the Federal Energy Regulatory Commission, Docket No. RP95-103-000, Written Testimony supporting FGT's proposed flexible service offerings, inflation-indexed rate, and removal of regulatory constraints on the secondary market for pipeline capacity. (1995)

Burlington Northern Railroad Company (Steptoe & Johnson, Washington, DC)

Southwestern Electric Power Company, Plaintiff, vs. Burlington Northern Railroad Company, Defendant, in the 102nd Judicial District Court of Bowie County, Texas, No. D-102-CV-91-720. Presented Oral Trial Testimony before a state court jury regarding the pricing provisions in two long-term coal transportation agreements, in defense against a claim by the shipper of

overcharges resulting from the contract rates failing to reflect the railroads' productivity improvements. (1994)

Houston Lighting & Power Company
Before the Texas Public Utilities Commission, Docket No. 12065, Written Testimony regarding appropriate regulatory policy changes dictated by emerging competition in electricity markets. (1994)

Boston Ventures Management (Boston)
Prepared a report for a venture capital firm on the adverse consequences on investment of the re-regulation of cable TV. (1994)

Kern River Gas Transmission Company (Salt Lake City)
Before the Public Service Commission of Utah, Application of Mountain Fuel Supply Company for Approval of Modifications to its Tariff to Implement a Firm Transportation Rate, Docket No. 94-057-02. Prepared Prefiled Direct and Rebuttal Testimony, as well as Oral Testimony, before the Public Service Commission of Utah regarding the appropriateness of a firm gas distribution tariff including within it costs of upstream pipeline transportation. (1994)

Burlington Northern Railroad Company (Steptoe & Johnson, Washington, DC)
In the Matter of the Arbitration between Public Service Company of Oklahoma and Burlington Northern Railroad Company. Delivered Written and Oral Testimony concerning the interpretation of the pricing and renegotiation provisions of a long-term coal transportation agreement. (1994)

Arco Pipe Line Company (Steptoe & Johnson, Washington, DC)
Prepared written *Comments in Response to Notice of Inquiry, Market-Based Ratemaking for Oil Pipelines, U.S. Federal Energy Regulatory Commission, Docket No. RM94-1-000.* (1994)

Kern River Gas Transmission Company (Wright and Talisman, Washington, DC)
Before the Federal Energy Regulatory Commission In the Matter of Kern River Gas Transmission Company, Docket No. RP92-226-000. Delivered Written and Oral Testimony regarding rate design for pipelines built under optional certificates. (1993)

ISK Biotech Corp. (Beveridge and Diamond, Washington, DC)
In the Matter of the Arbitration between ISK Biotech Corporation and Veterans Chemicals, Prepared Testimony regarding allocation rules and competitive impacts in an arbitration proceeding regarding data compensation under the Federal Insecticide, Fungicide and Rodenticide Act. (1993)

Geneva Steel Corp., *et al.* (Kimball, Parr, Waddoups, Brown & Gee, Salt Lake City)
Before the Utah Public Service Commission Docket No. 93-057-01, Written Testimony regarding antitrust implications of LDC treatment of pipeline charges under FERC *Order 636,* on behalf of a coalition of interruptible shippers. (1993)

Enron Gas Services Corp.

Co-authored study analyzing appropriate Public Utility Commission policy towards utility procurement of natural gas and emissions allowances in developing competitive markets. (1993)

New York Power Authority

Prepared analysis and delivered Public Hearing Testimony before the Board of Trustees regarding the economic consequences of below-market pricing for electricity. (1993)

Coalition of Non-Utility Generators

Co-authored study analyzing the effect of power from non-utility generators on electricity prices in New England. (1993)

U.S. Department of Commerce, Economics and Statistics Administration

Co-authored study analyzing the effect of U.S. environmental regulations on U.S. competitiveness. (1993)

International Energy Group

Before the Federal Energy Regulatory Commission, Docket No. PL91-1-000, Prepared Written Testimony regarding electricity transmission access policy. (June 1991)

El Paso Natural Gas Co. (Andrews & Kurth, Washington, DC)

Before the Federal Energy Regulatory Commission, Docket No. CP88-434-000, Prepared Written Testimony analyzing the extent of competition faced by El Paso as a seller of natural gas. (1989)

BOOKS AND EDITED VOLUMES

Innovation and its Discontents (with J. Lerner), Princeton University Press, 2004

Patents, Citations and Innovations: A Window on the Knowledge Economy (with M. Trajtenberg), M.I.T. Press, 2002

Innovation Policy and the Economy, (edited with J. Lerner and S. Stern), M.I.T. Press, Cambridge, Volume 1 (2001), Volume 2 (2001); Volume 3 (2002), Volume 4 (2003), Volume 5 (2005)

OTHER PUBLICATIONS

"Economics of Energy Conservation" (with R.G. Newell and R. N. Stavins), in Cutler Cleveland, ed., *Encyclopedia of Energy* , Elsevier, Inc. (forthcoming).

"Knowledge Flows Across Firm and National Boundaries" (with B. Gomes-Casseres and John Hagedoorn), ***The Journal of Financial Economics,*** forthcoming

"Market Value and Patent Citations: A First Look" (with B. Hall and M. Trajtenberg), *Rand Journal of Economics*, 2005

Comment on "Patent Citations and the Geography of Spillovers: A Reassessment" (with R. Henderson and M. Trajtenberg), *American Economic Review*, 2005

"Patent Citations and International Knowledge Flow: The Cases of Korea and Taiwan" (with A. Hu), *International Journal of Industrial Organization*, 2004

"Technological Change and the Environment" (with R. Newell and R. Stavins), in K.-G. Mäler and J. Vincent, eds., *Handbook of Environmental Economics*, North-Holland, 2003.

"Environmental Policy and Technological Change" (with R. Newell and R. Stavins), *Environmental and Resource Economics*, 2002.

"Building Programme Evaluation into the Design of Public Research-Support Programmes," *Oxford Review of Economic Policy*, 2002.

"Reinventing Public R&D: Patent Policy and the Commercialization of National Laboratory Technologies" (with J. Lerner), *Rand Journal of Economics*, Spring 2001.

"International Taxation and the Location of Incentive Activity" (with J.R. Hines, Jr.), in J.R. Hines, Jr., ed., *International Taxation and Multinational Activity*, University of Chicago Press, 2001.

"Knowledge Spillovers and Patent Citations: Evidence from a Survey of Inventors" (with M. Trajtenberg and M. Fogarty), *American Economic Review Papers and Proceedings*, May 2000.

"The Cigarette Industry," in W. Adams and J. Brock, eds., *The Structure of American Industry*, 10th edition, Prentice Hall, 2000.

"The U.S. Patent System in Transition: Policy Innovation and the Innovation Process," *Research Policy*, April 2000.

"Energy-Efficient Technologies and Climate Change Policies: Issues and Evidence" (with R. Newell and R. Stavins), Resources for the Future Climate Issue Brief No. 19, December 1999.

"The Regional Economic Impact of Public Research Funding: A Case Study of Massachusetts" (with A.B. Candell), in L.M. Branscomb, F. Kodama, and R. Florida, eds., *Industrializing Knowledge: University-Industry Linkages in Japan and the United States*, MIT Press, 1999.

"The Induced Innovation Hypothesis and Energy-Saving Technological Change" (with R. Newell and R. Stavins), *Quarterly Journal of Economics*, August 1999; reprinted in A. Grübler, N.

Nakicenovic, and W. Nordhaus, eds., *Technological Change and the Environment*, Resources for the Future, 2002.

"The Pipeline's View: FERC's Proposed Rule Misses" (with J. Lukens), *Public Utilities Fortnightly*, July 1, 1999.

"Special Issue on Geography and Innovation" (with R. Henderson), introduction to *Economics of Innovation and New Technology*, Vol. 8, 1999.

"International Knowledge Flows: Evidence from Patent Citations" (with M. Trajtenberg), *Economics of Innovation and New Technology*, Vol. 8, 1999.

Comment on "Inventors, Firms and the Market for Technology in the Late Nineteenth and Early Twentieth Centuries," in D. Raff, N. Lamoreaux and P. Temin, eds., *Learning by Doing in Markets, Firms, and Nations*, The University of Chicago Press, 1999.

"The Importance of 'Spillovers' in the Policy Mission of the Advanced Technology Program," *Journal of Technology Transfer*, Summer 1998.

"Inside the Pin-Factory: Empirical Studies Augmented by Manager Interviews: Introduction" (with Severin Borenstein and Joseph Farrell), *Journal of Industrial Economics*, June 1998.

"Evidence from Patents and Patent Citations on the Impact of NASA and Other Federal Labs on Commercial Innovation" (with Bruce A. Banks and Michael S. Fogarty), *Journal of Industrial Economics*, June 1998.

Comment on "What Do Technology Shocks Do?" in Bernanke, Ben S., and Julio Rotemberg, eds., *NBER Macroeconomics Annual, 1998.*

"Universities as a Source of Commercial Technology: A Detailed Analysis of University Patenting, 1965-1988" (with Rebecca Henderson and M. Trajtenberg), *Review of Economics and Statistics*, February 1998; also published in a slightly different form as "University Patenting Amid Changing Incentives for Commercialization" in G.B. Navaretti, P. Dasgtupta, K.-G. Maler and D. Siniscalco, eds., *Creation and Transfer of Knowledge*, Springer, 1998.

"Measurement Issues," in L.M. Branscomb & J. Keller, eds., *Investing in Innovation*, MIT Press, 1998.

"University Versus Corporate Patents: A Window on the Basicness of Invention" (with M. Trajtenberg and R. Henderson), *Economics of Innovation and New Technology*, 1997.

"Environmental Regulation and Innovation: A Panel Data Study" (with K. Palmer), *Review of Economics and Statistics*, November 1997.

Review of *Green, Inc.*, by Frances Cairncross, *Journal of Economics Literature*, March 1997.

"Bounding the Effects of R&D: An Investigation Using Linked Establishment and Firm Data" (with J. Adams), *Rand Journal of Economics*, winter 1996

"Economic Analysis of Research Spillovers: Implications for the Advanced Technology Program," Economic Assessment Office, The Advanced Technology Program, National Institutes of Standards and Technology, U.S. Department of Commerce, November 1996.

"Flows of Knowledge from Universities and Federal Labs: Modelling the Flow of Patent Citations over Time and across Institutional and Geographic Boundaries" (with M. Trajtenberg), *Proceedings of the National Academy of Sciences*, Vol. 93, pp. 12671-12677, November 1996.

"Trends and Patterns in U.S. Research and Development Expenditures," *Proceedings of the National Academy of Sciences*, Vol. 93, pp. 12658-12663, November 1996.

"Should Electricity Markets Have A Capacity Requirement: If So, How Should It Be Priced?" (with F. Felder), *The Electricity Journal*, December 1996.

"Regional Localization of Technological Accumulation: Application to the Tri-State Region," *The Annals of the New York Academy of Sciences*, 1996.

Comment on "Cross-Country Variations in National Economic Growth Rates" by J. Bradford Delong, in *Technology and Growth*, J.C. Fuhrer and J. Sneddon Little, eds., Federal Reserve Bank of Boston Conference Series No. 40, June 1996.

"Regulatory Reform and the Economics of Contract Confidentiality: The Example of Natural Gas Pipelines" (with J. P. Kalt, S. T. Jones, and F. A. Felder), *Regulation*, 1996, No 1.

"Planning for Change, Preparing for Growth: Implications for Massachusetts of Reductions in Federal Research Spending" (with Amy B. Candell, Kenneth W. Grant, Michael Laznik, and Kelly T. Northrop), The Economics Resource Group, Inc., funded by the Massachusetts Technology Collaborative, February 1996.

"Incentive Regulation for Natural Gas Pipelines" (with J. Kalt), in Ellig, J. and J. P. Kalt, eds., *New Horizons in Natural Gas Deregulation*, Praeger, 1996.

"The Emerging Coexistence of Competition and Regulation in Natural Gas Transportation" (with S. Makowka), *Hume Papers on Public Policy*, 1995.

"On the Microeconomics of R&D Spillovers" (with J. Adams), in Louis Lefebvre, ed., *Technology Management*, Paul Chapman Publishing, Ltd., 1995.

"An Economic Analysis of Electricity Industry Restructuring in New England" (with J. P. Kalt), The Economics Resource Group, Inc., funded by Northeast Utilities System Companies, April 1995.

"Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion" (with R. Stavins), *Journal of Environmental Economics and Management*, 1995.

"Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?" (with S. Peterson, P. Portney and R. Stavins), *The Journal of Economic Literature*, 1995; reprinted in Alan M. Rugman and John J. Kirton, eds., *Trade and the Environment: Economic, Legal and Policy Perspectives*, Cheltenham, UK: Edward Elgar Publishing Limited, 1998.

Comment on "Taxes, Technology Transfer, and the R&D Activities of Multinational Firms" by James R. Hines, Jr., in Martin Feldstein, James R. Hines, Jr., and R. Glenn Hubbard, eds., *The Effects of Taxation on Multinational Corporations*, University of Chicago Press, 1995.

"The Energy-Efficiency Gap" (with R. Stavins), *Energy Policy*, 1994.

"The Investment Consequences of the Re-Regulation of Cable Television" (with W. Emmons and J. Taylor), The Economics Resource Group, Inc., Cambridge MA, 1994.

"Insight on Oversight" (with J. Kalt), *Public Utilities Fortnightly*, April 15, 1994.

"The Energy Paradox and the Diffusion of Conservation Technology" (with R. Stavins), *Resource and Energy Economics*, 1994.

"Energy-Efficiency Investments and Public Policy" (with R. Stavins), *The Energy Journal*, 1994.

"Prices, Regulation and Energy Conservation: An Econometric Analysis" (with R. Stavins), delivered at the Conference on Market Approaches to Environmental Regulation, Stanford University, December 1993.

Comment on "R&D and Market Value in the 1980s" by Bronwyn Hall, *Brookings Papers on Economic Activity, Microeconomics*, 1993.

"The Effect of Liquidity on Firms' R&D Spending" (with K. Hao), *Economics of Innovation and New Technology*, 1993.

"Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations" (with M. Trajtenberg and R. Henderson), *Quarterly Journal of Economics*, August 1993.

"Environmental Regulations and the Competitiveness of U.S. Industry" (with S. Peterson, P. Portney, and R. Stavins), U.S. Department of Commerce, Economics and Statistics Administration, Washington, DC, NTIS No. PB-93-193514, July 1993.

"Oversight of Regulated Utilities' Fuel Supply Contracts: Achieving Maximum Benefit from Competitive Natural Gas and Emission Allowance Markets" (with J. P. Kalt), The Economics Resource Group, funded by Enron Gas Services Corporation, April 1993.

"Achieving Maximum Benefit from Competitive Natural Gas and Emission Allowance Markets" (with J. Kalt), *Proceedings of the U.S. Department of Energy/National Association of Regulatory Utility Commissioners Conference on Natural Gas Use, State Regulation and Market Dynamics in the Post 636/Energy Policy Act Era*, March 1993.

"The Diffusion of Energy-Conserving Windows: The Effect of Economic Incentives and Building Codes" (with R. Stavins), presented at the American Economic Association annual meeting, Anaheim CA, January 1993.

"How High are the Giants' Shoulders: An Empirical Assessment of Knowledge Spillovers and Creative Destruction in a Model of Economic Growth" (with R. Caballero), in O. Blanchard and S. Fischer, eds., *National Bureau of Economic Research Macroeconomics Annual, Vol. 8*, MIT Press, 1993; reprinted in Gene M. Grossman, ed., *Economic Growth: Theory and Evidence*, Vol. II, Cheltenham, UK: Edward Elgar Publishing Limited, 1996.

Review of *Investing in the Future*, by John Irvine, *et al.*, *Journal of Economic Literature*, June, 1992.

Review of *Productivity and U.S. Economic Growth* by D. Jorgenson, *et al.*, *Business History Review*, 1991.

"Evaluating the Relative Effectiveness of Economic Incentives and Direct Regulation for Environmental Protection: Impacts on the Diffusion of Technology" (with R. Stavins), *CSIA Discussion Paper No. 91-1*, Center for Science and International Affairs, Environment and Natural Resources Program, John F. Kennedy School of Government, Harvard University, February 1991.

"Economic Evaluation of Policy Options for Global Climate Change: Some Methodological Reflections," Center for Energy and Environmental Policy, John F. Kennedy School of Government, Harvard University, August 1990.

"Market Power of Local Cable Television Franchises: Evidence from the Effects of Deregulation" (with D. Kanter), *Rand Journal of Economics*, summer 1990.

"Unintended Impacts of Public Investments on Private Decisions: The Depletion of Forested Wetlands" (with R. Stavins), *American Economic Review*, June 1990.

"Universities and Regional Patterns of Commercial Innovation," *REI Review*, Center For Regional Economic Issues, Case-Western Reserve University, 1989.

"Real Effects of Academic Research," *American Economic Review*, December 1989; reprinted in Paula E. Stephan and David B. Audretsch, eds., *The Economics of Science and Innovation*, Cheltenham, UK: Edward Elgar Publishing Limited, 2000.

"Characterizing the 'Technological Position' of Firms, with Application to Quantifying Technological Opportunity and Research Spillovers," *Research Policy*, 1987.

"Demand and Supply Influences in R&D Intensity and Productivity Growth," *Review of Economics and Statistics*, August 1988.

"Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits and Market Value," *American Economic Review*, December 1986; reprinted in Edward N. Wolff, ed., *The Economics of Productivity*, Cheltenham, UK: Edward Elgar Publishing Limited, 1997.

"Who Does R&D and Who Patents" (with J. Bound, *et al.*), in Z. Griliches, ed., *R&D, Patents and Productivity*, University of Chicago Press, 1984.

"Benefit-Cost Analysis and Multi-Objective Evaluation of Federal Water Projects," *Harvard Environmental Law Review*, 1980.

"Preventing Groundwater Pollution: Towards a Coordinated Strategy to Protect Critical Recharge Zones (with J.T.B. Tripp), *Harvard Environmental Law Review*, 1979.

OTHER PROFESSIONAL ACTIVITIES

Guest Associate Editor, Management Science Special Issue: "Managing Knowledge in Organization," 2001

Co-organizer, National Bureau of Economic Research Innovation Policy and the Economy Group, 1999-present

Member, National Academy of Engineering Committee on the Impact of Academic Research on Industrial Performance, 1998-2001

Lead author, Third Assessment Report, Intergovernmental Panel on Climate Change, 1998-2001

Associate Editor, *Rand Journal of Economics*, 1997-2003

Member, Economics Roundtable, Advanced Technology Program, U.S. National Institute of Standards and Technology, 1995-present

Member, Board of Editors, *Journal of Industrial Economics*, 1995-2003

Member, Board of Editors, *American Economic Review*, 1995-2000

Co-organizer of the National Bureau of Economic Research Science and Technology Policy Research Workshop, 1995-1998

Project Coordinator, National Bureau of Economic Research Project on Industrial Technology and Productivity, 1994-1999

Member, Stanford Energy Modeling Forum, Working Group on Competitive Electricity Markets (EMF 15)

Member, Economic Impact Committee, Association of University Technology Managers, 1994-1995

Contributing Author, Working Group III (socioeconomics) of the Intergovernmental Panel on Climate Change (IPCC), 1993-1994

Member, Stanford Energy Modeling Forum, Working Group on Energy Conservation (EMF 13), 1992-94

Referee/reviewer for *American Economic Review, Journal of Applied Econometrics, Econometrica, Economic Inquiry, Economic Journal, Economics of Innovation and New Technology, Journal of Economics Organization and Management, Journal of Environmental Economics and Management, Journal of Health Economics, Journal of Industrial Economics, Journal of Law and Economics, Journal of Political Economy, Quarterly Journal of Economics, Rand Journal of Economics, Research Policy, Review of Economics and Statistics, Science*, and MIT Press.

TEACHING EXPERIENCE

Introductory Economics (undergraduate), Microeconomic Theory (Ph.D.), Law and Economics (undergraduate), Environmental and Natural Resource Economics (undergraduate), Industrial Organization (Ph.D. and undergraduate), Government Regulation and Antitrust Policy (Ph.D. and undergraduate), R&D, Innovation and Productivity Growth (undergraduate), Applied Welfare Economics (John F. Kennedy School of Government)

Foundation for American Communications, economics education for journalists, "The Role of Government in the Economy" (1996)

Designed and implemented a two-year Policy Analysis Lecture Series for the U.S. Army Corps of Engineers, New England Division, Regulatory Branch (1988-89)

HONORS AND AWARDS

Research Associate, 1994-present, and Faculty Research Fellow, 1985-1994, National Bureau of Economic Research

Principal Investigator, National Science Foundation Grant, "A Protocol for Empirical Measurement of the Impact of Public Research Funding," 2000-2001.

Co-Principal Investigator, U.S. Department of Energy Grant, "The Effects of Government Policies on the Invention, Innovation, and Diffusion of Energy-Efficient Technologies," 1998-2001.

Co-Principal Investigator, U.S. Department of Energy Research Grant, "Energy-Efficiency Innovation and the Economic and Regulatory Environment," 1995-1998

Project Director, National Science Foundation Research Grant, "Using Patent Citation Data to Trace Knowledge Flows," 1994-97

Project Director, National Science Foundation Research Grant, "The Sources and Effects of Knowledge Spillovers," 1994-97

Invited Speaker, National Academy of Sciences Symposium: *Science and the Economy*, April 1994

Co-Principal Investigator, National Science Foundation Research Grant, "Getting Down to Basics: Using University and Corporate Patents to Identify Basic Inventions and Trace Their Diffusion," 1991-92

Co-Principal Investigator, Environmental Protection Agency Exploratory Research Grant, "Evaluating the Relative Effectiveness of Economic Incentives and Direct Regulation for Environmental Protection: Impacts on the Diffusion of Technology," 1991-93

Alfred P. Sloan Dissertation Fellowship, Harvard, 1984-85

Alfred P. Sloan Research Fellowship, MIT, 1976-77

Phi Beta Kappa, 1976