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Shapley Values—A Cautionary Tale

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Abstract

The federal government requires certain music copyright holders to license their work to qualifying streaming services at government-set rates. Those rates are determined in adversarial hearings before an administrative entity called the Copyright Royalty Board (CRB). The CRB for many years made the necessary determinations by, among other things, studying evidence from analogous markets. For the past ten years, however, the CRB has relied in addition on a game-theoretic concept known as the Shapley Value, which was first proposed in 1953 by Nobel Prize winner Lloyd Shapley. Shapley's algorithm allocates economic surplus in instances where some number of distinct entities jointly produce a shared profit. The approach purports to achieve a "fair" division of that profit as between the relevant parties, accounting for each party's unique costs and each party's unique contributions.

This new point of emphasis has had jarring impact, with billions of dollars today changing hands under either Shapley-influenced government rates or private-party deals negotiated in their shadow. In this Article, I argue that the experts who convinced the CRB to adopt Shapley analysis got their economics wrong. Shapley analysis, it turns out, does not even purport to reflect baseline market outcomes that a regulator might then beneficially adjust. Nor does it offer any built-in levers by which regulators might quantify market power or measure other market imperfections. Most problematically, Shapley

* Professor of Law, UCLA. In 2022, I was invited to testify on these issues before the Copyright Royalty Board in the context of the then-pending *Phono IV* proceeding. I submitted a short expert declaration on behalf of Amazon Music, but *Phono IV* settled before I had the chance to meaningfully voice my views. This Article is the result. For helpful comments, my thanks to Josh Branson, Madeleine Higgs, Tod Kendall, Aaron Panner, Xiyin Tang, Richard Watt, an anonymous referee, and the team at Harvard JSEL. All views expressed here are obviously my own.

analysis is an unapologetically static framework that neglects both strategic play and long-run incentives—limitations that make it wholly inappropriate for copyright law, a set of rules fundamentally designed to inspire strategic responses and shape long-run decision-making.

Introduction

In the United States, an administrative agency called the Copyright Royalty Board (CRB) sets rates for various compulsory licenses. Under those licenses, qualified parties can pay a government-set fee and then use implicated work without obtaining direct permission from the relevant copyright holders. Some of the licenses allow cable television systems to retransmit, at regulated rates, copyrighted content originally aired on broadcast television.[1] Others authorize companies like Pandora and Spotify to stream copyrighted music on their technology platforms, again without the need for direct negotiation.[2] The CRB has traditionally used a range of tools to set prices for these obligatory licenses. For instance, the CRB's three Judges[3] have historically used simulations to identify plausible rates, and they have also used, as benchmarks, privately negotiated deals involving similar rights and similar parties.[4]

In 2006, the economist Michael Pelcovits submitted to the CRB an expert report urging that, in addition to those other approaches, the Judges should rely on a game-theoretic construct known as the Shapley value.[5] Named for the Nobel Prize winning economist Lloyd Shapley, the Shapley value was already at that time a well-regarded algorithm for allocating economic returns in instances where some number of distinct entities together

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[1] *See* 17 U.S.C. §§ 111, 119, 122.

[2] *See* 17 U.S.C. §§ 112, 114.

[3] I use the capitalized word "Judges" to refer to the three CRB judges, reserving the uncapitalized version for instances where I am referring to other judges, such as the judges who decided various cases I cite.

[4] *See, e.g.,* Digital Performance Right in Sound Recordings and Ephemeral Recordings, 76 Fed. Reg. 13026, 13028 (Copyright Royalty Bd. Jan. 5, 2011) (considering a simulation proposed by a testifying economist); *id.* at 13031 (considering benchmark agreements involving "similar buyers and sellers" and "a similar set of rights").

[5] *See* Testimony of Michael Pelcovits, Adjustment of Rates and Terms for Preexisting Subscription Services and Satellite Digital Audio Radio Services, (Copyright Royalty Bd. Oct. 27, 2006) [hereinafter Pelcovits].

generate a shared profit or together incur a shared cost.[6] Pelcovits proposed that this approach be used by the CRB to set rates for a license relevant to satellite radio. "The Shapley solution," he argued, has "a strong normative claim to being the best and 'fairest'" mechanism by which "to calculate the division of economic surplus."[7] He described it as "a fair solution"[8] and promised that it can "represent results that would be observed in the marketplace."[9] The CRB ultimately disagreed, according Pelcovits' Shapley model "little weight" because, among other problems, Shapley analysis wrongly ignores each stakeholder's incentive to "make its decisions independently" and thereby "to maximize their own profits."[10]

Case closed? Hardly. Nine years later, the CRB needed to decide the proper allocation of roughly $1 million in fees that had been collected from various cable companies and was ready to be distributed to two implicated copyright owners. The Judges did not cite their own prior discussion of Shapley analysis. They did not cite the old Pelcovits report either. Instead, they issued a written decision where they explicitly and without explanation complained that the parties to the proceeding had "neither applied nor approximated" what they characterized as "the optimal measure . . . of relative value in a distribution proceeding": the Shapley value, the very construct that the CRB had unequivocally rejected just a few years prior.[11]

Message heard. That next year, University of Toronto economist Joshua Gans filed a report with the CRB, applying Shapley analysis in the context of a proceeding related to online music streaming.[12] Next came a report from

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[6] I discuss Shapley analysis at length *infra* Part II.

[7] Pelcovits, *supra* note 5, at 23–24. Pelcovits does not much defend this assertion, explaining only that the Shapley approach "does not give any particular player any bargaining advantage over the others, because it averages situations where each player is at a bargaining advantage and a bargaining disadvantage." *Id.* at 23. This comment refers to a very specific detail in how the model works, even though it sounds like a more sweeping claim. *See infra* note 48 and accompanying text.

[8] *Id.* at 22. For support here, Pelcovits writes that the Shapley solution is "the most widely used model for allocating benefits in this manner and is widely endorsed by economists" and then cites an entry in New Palgrave Dictionary of Economics. *Id.* at 22–23.

[9] *Id.* at 24.

[10] Determination of Rates and Terms for Preexisting Subscription Services and Satellite Digital Audio Radio Services, 73 Fed. Reg. 4080, 4092 (Copyright Royalty Bd. Jan. 24, 2008).

[11] Distribution of 1998 and 1999 Cable Royalty Funds, 80 Fed. Reg. 13423, 13442 (Copyright Royalty Bd. Mar. 13, 2015) [hereinafter *Original Shapley Order*].

[12] Expert Report of Joshua Gans, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), (Copyright Royalty Bd. Oct. 31, 2016) [hereinafter *Gans 2016*].

Duke University economist Leslie Marx,[13] then the University of Canterbury's Richard Watt,[14] and then one from Princeton University's Robert Willig,[15] all applying Shapley analysis to compulsory licenses under the CRB's regulatory purview. The CRB, meanwhile, continued to endorse the approach. In rate decisions published in 2019 and 2023, for instance, the CRB explicitly relied on Shapley analysis to derive "reasonable rates and terms" for a specific license that governs the use of a song's words and notes.[16] And, in an intervening appellate case, the Judges defended their approach before the D.C. Circuit, convincing a unanimous appellate panel that this approach to pricing fell "well within the Board's discretion."[17]

But the CRB, the testifying economists, and the D.C. Circuit have it wrong. Shapley analysis is not remotely an appropriate framework by which to set rates for compulsory copyright licenses. The purpose of a compulsory license is to address some sort of market failure.[18] Perhaps transaction costs mean that private deals cannot be efficiently consummated without government intervention. Perhaps market power on the side of licensors threatens prices that are inefficiently high. Shapley analysis, however, helps with none of this. It does not purport to reflect baseline market outcomes from which

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[13] Written Direct Testimony of Leslie M. Marx, PhD, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), (Copyright Royalty Bd. Nov. 1, 2016) [hereinafter *Marx 2016*].

[14] Written Rebuttal Testimony of Richard Watt (PhD), Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), (Copyright Royalty Bd. Feb. 13, 2017) [hereinafter *Watt 2017*].

[15] Written Direct Testimony of Robert Willig, Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate those Performances (Web V), (Copyright Royalty Bd. Sept. 23, 2019) [hereinafter *Willig 2019*].

[16] *See* Determination of Royalty Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), 84 Fed. Reg. 1918, 1919 (Copyright Royalty Bd. Feb. 5, 2019) [hereinafter *Phono III Order*] (defining the scope of the proceeding); Determination of Royalty Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), 88 Fed. Reg. 54406, 54406 (Copyright Royalty Bd. Aug. 10, 2023) [hereinafter *Phono III Remand*] (same).

[17] Johnson v. Copyright Royalty Board, 969 F.3d 363, 385 (D.C. Cir. 2020).

[18] *See*, among many others, Stanley M. Besen et al., *Copyright Liability for Cable Television: Compulsory Licensing and the Coase Theorem*, 21 J.L. & Econ. 67 (1978) (explaining how compulsory licensing addresses various market failures); Ralph Oman, *The Compulsory License Redux: Will It Survive in a Changing Marketplace?*, 5 Cardozo Arts & Ent. L. Rev. 37 (1986) (same); Robert P. Merges, *Comment, Of Property Rules, Coase, and Intellectual Property*, 94 Colum. L. Rev. 2655, 2661–62 (1994) (same).

a regulator might then adjust. It does not offer any built-in levers by which regulators might quantify market power or account for other market imperfections. Moreover, even if compulsory licenses are meant to serve some other policy goal in this context—not merely mitigating the harms associated with transaction costs and market power, but affirmatively implementing some sui generis balancing of interests as between singers, songwriters, performers, producers, record labels, music publishers, streaming services, technology companies, and listeners[19]—there, too, Shapley analysis has no purchase, among other reasons because Shapley is a static framework that neglects both strategic play and long-run incentives. That makes it an unworkable mismatch for copyright law, a set of rules fundamentally designed to inspire strategic responses, create long-run incentives, and ultimately encourage the creation, distribution, and meaningful consumption of eligible work.[20]

Shapley analysis, in short, should never have been embraced by the CRB. I write here to articulate the case against it.

My argument proceeds as follows. In the first section, I offer some necessary background on copyright law. Specifically, I explain the rights relevant

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[19] There are hints along these lines in the statute. For instance, before it was amended in 2018, section 801(b) required that the CRB set rates that were "reasonable" in light of four statutory objectives: "maximize the availability of creative works to the public"; "afford the copyright owner a fair return for his or her creative work and the copyright user a fair income under existing economic conditions"; "reflect the relative roles of the copyright owner and the copyright user in the product made available to the public"; and "minimize any disruptive impact on the structure of the industries involved." Those words might simply have been Congress's way of articulating what a well-functioning market would naturally achieve. But it is possible that Congress here meant to introduce policy considerations beyond those that would be addressed by conventional market forces. Similarly, while section 115 requires the CRB to set rates that represent what "a willing buyer and a willing seller" would negotiate in the marketplace, that statutory provision goes on to require that the CRB consider "whether use of the compulsory licensee's service may substitute for or may promote the sales of phonorecords or otherwise may interfere with or may enhance the musical work copyright owner's other streams of revenue from its musical works" and "the relative roles of the copyright owner and the compulsory licensee in the copyrighted work and the service made available to the public with respect to the relative creative contribution, technological contribution, capital investment, cost, and risk." Again, Congress here might simply be explaining what a market would naturally achieve if transaction costs were eliminated and market power was constrained. But it is also possible that Congress meant to suggest yet further policy interventions. For an argument that compulsory licenses are best understood as implementing a sui generis balancing of interests, *see* Jacob Victor, *Reconceptualizing Compulsory Copyright Licenses*, 72 Stan. L. Rev. 915 (2020).

[20] *See infra* note 157 and accompanying text.

to music streaming, and I introduce the compulsory licenses that federal law makes available to streamers like Pandora, Spotify, iHeart, Amazon Music, and Apple Music. I focus this discussion on music streaming because, while the CRB has considered Shapley analysis in other contexts, to date the CRB has only applied Shapley analysis to streaming licenses. Next, I introduce Shapley analysis, sketching a numeric example, explaining the algorithm, and highlighting its admittedly appealing properties. As I explain, in appropriate settings, Shapley is a powerful mechanism by which to thoughtfully allocate both benefits and burdens.

My third section traces the adoption of Shapley analysis at the CRB. I start with the 2015 decision where the Judges first characterized it as the "optimal" framework and end with a June 2023 order that again endorsed the approach. I focus primarily on expert reports filed by various testifying economists, and I use them to document two critical realities: Shapley values have been held out as if they are reliable proxies for the rates that would obtain in a real-world competitive market; and Shapley analysis has likewise been explained as if it is a framework that can be used to reliably adjust for market power and account for other market imperfections. I disagree with these points, but the words and examples I highlight were all directly submitted to the CRB and thus surely influenced the Judges' perception of the Shapley approach.

The fourth section then makes my argument: that Shapley analysis is not descriptive of the real-world markets into which the CRB intervenes; that Shapley analysis does not offer any levers that regulators can use to reliably quantify market power or account for other market imperfections; that Shapley models are dangerously sensitive to the details of what turn out to be highly stylized, highly simplified inputs; and that Shapley analysis overall is a complete mismatch for copyright law regardless because Shapley analysis neglects both strategic play and long-run incentives, whereas copyright law is a set of rules designed to inspire strategic responses and shape long-run decision-making. In the fifth section, I briefly conclude.

I. The Licensing Landscape

Recorded music is protected by two types of copyrights.[21] The first, the "sound recording" copyright, applies to the output produced by singers,

[21] 17 U.S.C. §102(a) ("Works of authorship include . . . (2) musical works, including any accompanying words; … [and] (7) sound recordings").

musicians and other artists as they perform a musical work. Anything a listener ultimately hears can in theory be protected by the sound recording copyright. The second, the "musical work" copyright, applies to the underlying musical composition and thus protects the words, notes, and other non-auditory details that might be memorialized on physical sheet music. Typically, the rights to the musical work will initially vest in the songwriter, and the rights to the sound recording will initially vest in the performers. Because copyrights can be divided and transferred, however, a party that seeks to license a musical work and/or to license a sound recording often ends up needing permission from multiple intermediaries, each of whom might have authority to license some, but not all, of the necessary musical work and/or sound recording rights.[22]

While sound recording and musical work rights are intertwined in the sense that the use of a recorded song will often require permission from both the sound recording copyright holder and the musical work copyright holder, that relationship is not one-to-one. For instance, a songwriter can write a song, copyright the musical work, and then authorize a dozen performers to each record their own versions, thereby generating a dozen sound recording copyrights all associated with the same single musical work copyright. Similarly, a performer will sometimes record a musical work for which the copyright has expired, thereby creating a situation where the recorded performance is subject to only one copyright, namely the one that protects the sounds themselves.

Different licenses are then required for different uses. A radio station, for example, needs the right to publicly perform the musical work, but federal law does not obligate a radio station to acquire any license at all with respect to the sound recording, as long as the radio station has legitimate access to a CD, album, or other physical embodiment.[23] By contrast, a radio-like "non-interactive" streaming service—for example, a customized station offered by

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[22] *See, e.g.,* Dana A. Scherer, Cong. Rsch. Serv., R43984, Money for Something: Music Licensing in the 21st Century (2021) (explaining the typical business relationships and licensing patterns); The United States Copyright Office, *How Songwriters, Composers, and Performers Get Paid*, United States Copyright Office (Nov. 2020), https://www.copyright.gov/music-modernization/educational-materials/musicians-income.pdf [https://perma.cc/W98J-9SVE] (also explaining the typical relationships and patterns).

[23] *Compare* 17 U.S.C. §106(4) (recognizing a general right to authorize public performances of musical work) *with* 17 U.S.C. §106(6) (recognizing for sound recordings a performance right only by means of "digital audio transmission").

Pandora[24]—needs a different pattern of permissions. Noninteractive streaming services are offerings where a listener can specify a song, an artist, a theme, or otherwise offer an indication as to their musical preferences, but then the technology picks which songs are actually played.[25] Providers of noninteractive streaming need three licenses: like a radio station, these streamers must license the right to publicly perform the musical work; unlike a radio station, they also need the right to publicly perform the sound recording and the right to make temporary "ephemeral" copies of the sound recording to facilitate streaming.[26] Interactive streaming services, meanwhile—Spotify, Amazon Music, Apple Music—allow listeners to pick specific songs on demand.[27] For those, federal law requires five types of permission: like noninteractive streamers, interactive streamers need permission to publicly perform the sound recording, to reproduce ephemeral copies of the sound recording, and to publicly perform the musical work; then, in addition, interactive streamers also need what insiders call the "mechanical license," which is functionally a right to reproduce and distribute musical work.[28]

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[24] *See* In re Pandora Media, Inc., 6 F.Supp.3d 317, 327 (S.D.N.Y. 2014) ("A Pandora customer creates a station by 'seeding' it with a song, artist, genre, or composer. That seed serves as a starting point to which Pandora then applies the information in its [proprietary] database to match that seed with other songs that Pandora's algorithms predict that the listener is likely to enjoy.").

[25] My definition in the text is a simplified version of the definition that actually applies when the Copyright Royalty Board is policing the relevant copyright rights. For the fuller articulation, see 17 U.S.C. §114(d)(2)(C).

[26] *See* Joseph Dimont, *Royalty Inequity: Why Music Streaming Services Should Switch to a Per-Subscriber Model*, 69 Hastings L.J. 675, 682 (2018) (explaining the obligation to pay musical work copyright holders for public performance); Determination of Royalty Rates and Terms for Ephemeral Recording and Webcasting Digital Performance of Sound Recordings (Web IV), 81 Fed. Reg. 26316, 26316 (Copyright Royalty Bd. May 2, 2016) [hereinafter *Web IV Order*] (noninteractive webcasters must pay for both the performance of the sound recordings and for the ephemeral copies needed to transmit them).

[27] Again here I use a simplified definition. A more formal definition is codified at 17 U.S.C. §114(j)(7), but even that definition is incomplete, in that it fails to address countless critical details, including the proper characterization of a service that offers both interactive and noninteractive options, and the proper characterization of a service that does not allow user choice but does announce its playlists in advance. None of this matters for my analysis, however, and so, for my purposes, I adopt the colloquial, accessible definition offered in the text.

[28] *See* Daniel Abowd, *Something Old, Something New: Forecasting Willing Buyer/Willing Seller's Impact on Songwriter Royalties*, 31 Fordham Intell. Prop. Media & Ent. L.J. 574, 593 (2021) (discussing the required licenses); Brian T. Yeh, Cong. Rsch. Serv., RL33631, Copyright Licensing in Music Distribution,

There are policy, historical, and political explanations for all of these distinctions. By some accounts, for example, radio stations are not required to pay for sound recording rights because, even without a further payment, radio is thought to benefit singers, generating interest in their music that later translates into album sales and concert attendance.[29] Other accounts credit these inconsistencies to the sausage-making of politics, and to the challenges of balancing the public's interest in supporting creativity against its interest in promoting the development of new technologies.[30] For current purposes, the critical fact is only that a variety of rights must be licensed, and the details vary based on which delivery system is at issue.

The rates and terms for these various licenses are sometimes determined by way of unregulated marketplace negotiations. Spotify, for instance, has directly licensed sound recording rights from Sony Music Entertainment, Warner Music Group, and Universal Music Group, in deals that gave the rightsholders not only royalty payments but also equity interests in Spotify itself.[31] Often, however, rates and terms are either determined by government-defined rules or subject to specific types of governmental oversight. For example, the Copyright Royalty Board sets terms for several compulsory licenses, including a license that allows noninteractive streamers to perform copyrighted sound recordings,[32] a license that allows noninteractive streamers to reproduce copyrighted sound recordings,[33] and a license that

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Reproduction, and Public Performance Appendix A (2015) (listing the licenses); 17 U.S.C. §115 (creating a compulsory license that covers the reproduction and distribution of a nondramatic musical work in the context of interactive streaming).

[29] *See, e.g.*, Amanda M. Whorton, *The Complexities of Music Licensing and the Need for a Revised Legal Regime*, 52 Wake Forest L. Rev. 267, 272 (2017) ("Broadcasters have argued, and Congress has agreed, that the advertising and promotional value of airplay on broadcast radio far outweigh the revenue lost in royalties by the holders of the sound recording copyright.").

[30] *See*, among many others, Tim Wu, *Copyright's Communications Policy*, 103 Mich. L. Rev. 278 (2004) (discussing some of these explanations); Jessica Littman, Digital Copyright 56 (2006) (same).

[31] *See* Micah Singleton, *This was Sony Music's contract with Spotify*, The Verge (May 19, 2005) (discussing some of the financial terms of the license), https://www.theverge.com/2015/5/19/8621581/sony-music-spotify-contract [https://perma.cc/DC7B-ASLQ]; Jem Aswad, *Warner Music Group Sells Its Entire Stake in Spotify*, Variety (Aug. 7, 2018) (reporting the then-current status of each firm's stake in Spotify), https://variety.com/2018/biz/news/warner-music-group-sells-entire-stake-in-spotify-1202897605/ [https://perma.cc/95YC-47S7].

[32] 17 U.S.C. § 114(d)(2).

[33] 17 U.S.C. § 112(e).

allows interactive streamers to reproduce and distribute copyrighted musical works.[34] Meanwhile, the American Society of Composers, Authors and Publishers (ASCAP) and Broadcast Music, Inc. (BMI) are the two largest "performing rights organizations" in the United States, and, while they offer various licenses associated with musical works in the United States, both organizations are subject to antitrust consent decrees, negotiated with the Department of Justice, under which specific federal courts have the power to review and, under certain conditions affirmatively set, their licensing rates.[35]

These government-defined and government-influenced rates then influence more than just the specific transactions where they are invoked; they cast "shadows" over a wide variety of negotiations that are technically unregulated. Three distinct shadows are plausibly at play. First, government rates influence private deals that cover the same rights between the same parties, such as a consensual license that displaces a compulsory one and gives both licensor and licensee an outcome they perceive as advantageous as compared to the governmental default. Warner Music, for instance, struck a direct deal with iHeart Media covering rights that iHeart could have acquired by way of a compulsory license but offering an even lower rate in exchange for iHeart's commitment to favor Warner's artists in iHeart's programmed streams.[36] Second, government rates influence private deals that cover rights sufficiently similar to the regulated ones that either the licensor or the licensee believes that their private deal might later be used by the government as a benchmark for a related government license.[37] For instance, if a streamer believes that a consensual deal struck today will be used to justify higher compulsory rates tomorrow, the streamer might abandon the deal, or at least fight harder for a lower contractual number. Third, because government licenses are typically invoked in the context of more complicated transactions that involve both compulsory and unregulated licenses, the amount owed under the

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[34] 17 U.S.C. § 115.

[35] *See* Press Release, U.S. Dep't of Just. Office of Public Affairs, Department of Justice Opens Review of ASCAP and BMI Consent Decrees (June 5, 2019) (discussing the consent decrees and explaining the 'rate court' provisions); Xiyin Tang, *Copyright's Techno-Pessimist Creep*, 90 Fordham L. Rev. 1151, 1160–64 (2021) (same).

[36] *See Web IV Order*, *supra* note 26, at 26331 (explaining that Warner "voluntarily agreed to rates below the applicable statutory rates" in order to incentivize iHeart to "steer" more plays to Warner artists). *But see id.* at 26329 (expressing skepticism that the then-existing rates "meaningfully affect[ed] the steered rates" in the agreement).

[37] *See, e.g.*, *id.* at 26330 ("The record is replete with evidence that the parties entered into various transactions with the knowledge, if not the intent, that such agreements could be used as evidentiary benchmarks in this proceeding.").

government default can be a constraint on each parties' reservation price with respect to those intertwined but unregulated fees.[38] Put simply, if a streamer is willing to pay up to $1 for the use of a particular song, and the relevant compulsory license already requires an investment of 60 cents, that leaves only 40 cents to offer toward other rights, regardless of whether those rights are explicitly capped at 40 cents or not.

All this plays out in many different venues; but, for the purposes of this Article, the most important forum is the CRB. CRB proceedings are litigation-like interactions where interested parties present evidence, sponsor testimony, and submit economic, policy, and legal arguments in favor of their preferred rates and terms. Proceedings can play out over the course of multiple years, and the resulting rates typically apply for five-year periods before being adjusted based on new evidence presented in new proceedings.[39] CRB decisions are subject to judicial review, but only to confirm that the Judges neither acted in ways that were arbitrary or capricious nor otherwise disobeyed binding procedural rules.[40]

Because of the large number of proceedings, industry insiders use shorthand to make clear which rights, and which years, are at issue in any given proceeding. Three of those labels are useful here: *Phono III* considered rates and terms for the mechanical license relevant to interactive streaming for the years 2018 to 2022;[41] *Phono IV* addressed those same rates but for years 2023

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[38] *See, e.g.*, *Phono III Remand, supra* note 16, at 54420 (considering whether an increase in the regulated rate applicable to musical works would be offset nearly dollar-for-dollar by a decrease in the unregulated sound recording royalty charged to the same party—the supposed "seesaw" effect).

[39] For more detailed introductions to the CRB, its founding, and its practices, *see* Paul Musser, *The Internet Radio Equality Act: A Needed Substantive Cure for Webcasting Royalty Standards and Congressional Bargaining Chip*, 8 Loyola Law & Tech Ann. 1, 18–21 (2008); Erich Carey, *We Interrupt This Broadcast: Will the Copyright Royalty Board's March 2007 Rate Determination Proceedings Pull the Plug on Internet Radio?*, 19 Fordham Intell. Prop. Media & Ent. L.J. 257, 283–84.

[40] This is the standard generally used when a court reviews a decision made by an administrative agency under the Administrative Procedure Act. *See* Johnson v. Copyright Royalty Board, 969 F.3d 363, 375 (D.C. Cir. 2020) (explaining that a CRB decision, like most other decisions from an administrative agency, can be set aside only if it is shown to be "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, or if the facts relied upon by the agency have no basis in the record").

[41] *See* Determination of Royalty Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), 81 Fed. Reg. 255, 255 (Copyright Royalty Bd. Jan. 5, 2016) ("The Copyright Royalty Judges announce commencement of a proceeding

to 2027;[42] and *Web V* addressed rates and terms for the ephemeral copying and public performance sound recording licenses applicable to noninteractive streaming from 2021 to 2025.[43] In this Article, I refer to those three proceedings using these shorthand monikers.

II. Shapley Values

In 1953, the mathematician and economist Lloyd Shapley proposed what has since become known as the Shapley value.[44] The proposal is in essence an algorithm for dividing economic returns in instances where some number of distinct entities together generate a shared profit or together incur a shared cost. It is said to achieve a "fair" allocation of that benefit or burden as between the relevant parties, specifically by accounting for each party's marginal contribution to the whole. Shapley would win the Nobel Prize in Economic Sciences in part for this work,[45] and over the decades his idea has been expanded and dissected in numerous academic papers, book chapters, and textbooks.[46]

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to determine reasonable rates and terms for making and distributing phonorecords for the period beginning January 1, 2018, and ending December 31, 2022.").

[42] *See* Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV), 86 Fed. Reg. 325, 325 (Copyright Royalty Bd. Jan. 5, 2021) ("The Copyright Royalty Judges announce commencement of a proceeding to determine reasonable rates and terms for making and distributing phonorecords for the period beginning January 1, 2023, and ending December 31, 2027.").

[43] *See* Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate those Performances (Web V), 84 Fed. Reg. 359, 359 (Copyright Royalty Bd. Jan. 24, 2019) ("The Copyright Royalty Judges (Judges) announce commencement of a proceeding to determine reasonable rates and terms for two statutory licenses permitting the digital performance of sound recordings over the internet and the making of ephemeral recordings to facilitate those performances for the period beginning January 1, 2021, and ending December 31, 2025.").

[44] Lloyd S. Shapley, *A Value for n-Person Games, in Contributions to the Theory of Games, reprinted in* The Shapley Value: Essays in Honor of Lloyd S. Shapley 31, 31–40 (Alvin E. Roth ed., 1988) [hereinafter *The Shapley Reprint*].

[45] *See* Barry Meier, *Lloyd S. Shapley, 92, Nobel Laureate and a Father of Game Theory, Is Dead*, The New York Times, March 14, 2016 (a warm remembrance honoring Professor Shapley, his work, and his Nobel Prize win).

[46] *See, e.g., The Shapley Reprint*, *supra* note 44; Edward Rosenthal, *The Complete Idiot's Guide to Game Theory* 161–74 (2011) (explaining the concept by way of simple examples); Howard Raiffa, *The Art and Science of Negotiation* 257–74 (1982) (explaining the concept through a more formal presentation); Martin J. Osborne &

Shapley's algorithm is typically expressed in mathematically sophisticated ways, but the concept is more accessibly introduced by way of a simple example. Imagine that three friends are leaving a restaurant to travel to their respective homes.[47] They can each take their own taxi, but, because their paths overlap, they decide to hire one taxi and share the cost. The most efficient, straight-line route is to drop Ann first, then Bob, then Chris, and the friends expect that the meter will show $30 when arriving at Ann's home, $44 when arriving at Bob's, and $54 when arriving at Chris's. The question for the friends is how to divide the total $54 fare among them, given their various partial overlaps.

One option would be to focus on the actual order in which the friends arrive at their respective homes. Under this approach, Ann would pay the initial $30 because that is the fare associated with her part of the trip. Bob would pay the next $14, which is the additional cost required to travel from Ann's house to Bob's. Chris would then pay the final $10, as he at that point is riding alone. This allocation has the virtue of being administratively simple, in that riders simply pay the residual amounts due whenever they exit the cab, but the allocation disproportionately favors Chris. After all, Chris literally enjoys a free ride for the entire shared portion of the trip; he contributes only to the final portion, a portion that exclusively benefits him anyway.

Consider, then, an alternative "arrival" sequence, such as Bob, then Chris, then Ann. Under this pattern, Bob would pay $44, which is the total cost for his part of the ride; Chris would pay $10 when he exits; and Ann this time would be the lucky one, because in this pattern the full fare is covered without her paying a dime. Note that the "arrival" concept here is conceptual. The taxi in this variation takes the same path it did in the prior one; only the payment obligations change based on the newly proposed theoretical order.

Shapley's algorithm balances these various scenarios by cataloging every possible permutation, calculating the resulting payment patterns, and

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Ariel Rubinstein, *A Course in Game Theory* 289–98 (1994) (explaining the concept through a full mathematical presentation); Michael Maschler et al., *Game Theory: Second Edition* 796–822 (2013) (same); Roger B. Myerson, *Game Theory: Analysis of Conflict* 417–77 (1991) (same).

[47] My example here is based on an example from Rosenthal, *supra* note 46. I changed the numbers so as to avoid decimals, but I otherwise followed his lead in terms of using a shared taxi ride to demonstrate the workings of Shapley's model. I am apparently not the only one to think well of this particular example. Indeed, as of this writing, the Wikipedia entry for "Shapley value" includes a link to a YouTube video entitled "Calculating a Taxi Fare using the Shapley Value." *See* https://en.wikipedia.org/wiki/Shapley_value [https://perma.cc/V6S5-52XJ] (last visited Sept. 4, 2023).

ultimately averaging the payments to determine each person's "fair" share.[48] In this example, there are six possible sequences to consider: using first initials, ABC, ACB, BAC, BCA, CAB, and CBA. Those options, the fares, and the resulting averages are shown in the table. The upshot is that, out of the total $54 owed, Shapley would have Ann pay $10, Bob $17 and Chris $27. And, as promised, that result *does* align with an intuitively "fair" outcome. The first leg of the trip benefits all three riders, so they each pay one third of the $30 cost. The second leg benefits just Bob and Chris, so they in addition pick up half of that next $14. The final leg benefits only Chris and so Chris pays the additional $10 himself. Ann ends up paying a total of $10, Bob a total of $10 + $7 or $17, and Chris $10 + $7 + $10, or $27.

Conceptual Payment Order	Amount Paid A	B	C
A, then B, then C	30	14	10
A, then C, then B	30	0	24
B, then A, then C	0	44	10
B, then C, then A	0	44	10
C, then A, then B	0	0	54
C, then B, then A	0	0	54
Averages:	10	17	27

Again, Shapley's paper introduced all of this more formally, and with none of the public policy overlay. He defined his model mathematically, and, instead of offering a concrete example like individual riders sharing portions of a journey, he articulated the formation of abstract "coalitions" where "players" team up to generate unspecified economic returns.[49] As to the policy overtones, Shapley in this paper did not articulate any specific notion of fair play nor did he champion any specific applications for the algorithm. Instead, perhaps because he was writing at a time when game theory was still

[48] This process of averaging the permutations is what the economist Michael Pelcovits was referring to when he asserted that the Shapley approach "does not give any particular player any bargaining advantage over the others, because it averages situations where each player is at a bargaining advantage and a bargaining disadvantage." Pelcovits, *supra* note 5, at 23.

[49] *The Shapley Reprint*, *supra* note 44, at 32.

a relatively new field of inquiry, his focus was on the nuts and bolts of the modeling. Indeed, the bulk of his paper was invested in proving certain axioms about his approach, including that the sum of the payments add up to no more, and no less, than the actual total (confusingly, he called this there-is-no-waste property "efficiency"[50]) and that his approach yields consistent results if, instead of considering the full interaction in the context of a single model, a modeler were to break the interaction into smaller subgames, analyze those, and then combine the payoffs.[51]

The next year, Shapley did publish a co-authored paper applying his eponymous construct to a real-world situation, specifically using it to measure the influence that various voting systems accord to each marginal voter.[52] Interestingly, in that paper, Shapley very explicitly warns that his model does "not take into account any of the sociological or political superstructure that almost invariably exists," is "not intended to be a representation of present day 'reality,'" and suffers "many other practical difficulties" that might limit its explanatory power.[53]

III. Shapley Values at the CRB

In 2015, the Copyright Royalty Board took the first step in what would become a critical change to the Board's decision-making processes. At issue was the final distribution of monies that had been deposited by cable system operators as legally required payment for the right to retransmit certain television programs that had already been broadcast on regular, over-the-air television. The CRB was responsible for distributing this money, and, although the Judges had already distributed approximately $127 million to relevant parties, a residual $1 million remained to be allocated as between two final copyright claimants.[54] The controlling statute did not dictate any particular standard for rendering this allocation. The Judges, however, had previously committed to distribute funds according to the "relative marketplace value"

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[50] *Id.* at 41 ("The second axiom ('efficiency') states that the value represents a distribution of the full yield of the game.").

[51] *See id.* (explaining the "law of aggregation").

[52] *See* Lloyd S. Shapley & Martin Shubik, *A method for evaluating the distribution of power in a committee system*, 48 American Political Science 787, 787–92 (1954), *reprinted in The Shapley Reprint*, *supra* note 44, at 41–48.

[53] *Id.* at 46.

[54] *Original Shapley Order*, *supra* note 11, at 13423 n.2.

of the respective claimants' programs, consistent with the "hypothetical market that would exist but for the compulsory license regime."[55]

The Judges focused their analysis on transaction costs. Indeed, as the Judges explained, the motivation for government regulation in this particular instance was the worry that "prohibitively high transaction costs" would be incurred were cable providers forced to negotiate directly with every relevant copyright holder.[56] The Judges thus set out to imagine a hypothetical friction-free transaction between "a willing buyer and a willing seller, neither being under any compulsion to buy or sell, and both having reasonable knowledge of relevant facts."[57]

This could have led to very traditional types of economic analysis. The Judges could have considered evidence from analogous markets, for instance, or they could have relied on simulations, all the while asking conventional questions about marginal cost and competitive entry.[58] But the Judges instead turned to Shapley analysis. Their final written determination included a section entitled "The Optimal Economic Approach to Determining Relative Market Value," and, in it, they cited Shapley's foundational paper and explained the basic workings of his pioneering approach.[59] "The Shapley value gives each player his average marginal contribution to the players that precede him," wrote the Judges, "where averages are taken with respect to all potential orders of the players."[60] The Judges even offered a simple three-party example, with one player representing the first copyright claimant, one representing the second copyright claimant, and one representing a generic cable operator. The decision as published in the Federal Register included a chart showing the six conceptual permutations and some sample numeric calculations.[61]

The modeling was flawless. It cited and accurately reflected Shapley's original work. It cited and accurately reflected an academic paper from 2010 by University of Canterbury Professor Richard Watt that had championed Shapley analysis as a "way in which the surplus that is generated by the music

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[55] *Id.* at 13428 (emphasis removed).

[56] *Id.*

[57] *Id.*

[58] To be fair, the Judges might well have preferred to use these conventional approaches, had the parties offered the requisite evidence. *See id.* at 13428 n.22 (complaining that "the parties to this proceeding did not proffer evidence of any simulations" and "did not provide evidence or testimony from sellers/licensors and buyers/licensees in 'analogous' markets").

[59] *Id.* at 13429.

[60] *Id.* (internal quotations omitted).

[61] *Id.* at 13430.

radio industry can be shared, in a fair and equitable manner, between the broadcasters and the suppliers of music content."[62] But the text that followed characterized the approach in ways that seem impossible to defend. Quoting from a paper by economists Sergiu Hart and Andreu Mas-Colell, the Judges asserted that "Shapley valuations constitute the unique efficient solution, because they value each player's direct marginal contribution to a grand coalition."[63] That quote is literally correct, but Hart and Mas-Colell had used the word "efficient" in the same way that Shapley had, not meaning that the algorithm achieves ideal productivity given available resources, but instead meaning that the algorithm allocates all the available money.[64] A few paragraphs later, the Judges went further, describing Shapley analysis as "the optimal theoretical manner" by which to "establish . . . relative marketplace values."[65] The Judges offered no explanation for this claim, nor did they provide supportive citations to the academic literature beyond their citations to Shapley's original work, Watt's 2010 paper, and the possibly mischaracterized Hart/Mas-Colell piece. Missing, too, was any citation to or discussion of the CRB's own written decision from seven years earlier, where the Judges had rejected Shapley analysis in another context.[66] And there they stopped, because the parties to this particular proceeding had not themselves applied Shapley analysis to the facts at hand and thus had not submitted any of the necessary evidence or testimony. After considering "whether they could decline to make any distribution determination in light of the imperfections of the parties' evidence,"[67] the Judges begrudgingly allocated the disputed $1 million using "viewership" as a proxy for relative program value.[68] But the CRB's message was clear, and stakeholders immediately answered the call.

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[62] Richard Watt, *Fair Copyright Remuneration: The Case of Music Radio*, 7 Rev. of Econ. Rsch. on Copyright Issues 21, 35 (2010).

[63] *Original Shapley Order*, *supra* note 11, at 13430 (internal punctuation omitted).

[64] *See* Sergiu Hart & Andreu Mas-Colell, *The Potential of the Shapley Value*, *in* The Shapley Value: Essays in Honor of Lloyd S. Shapley, *supra* note 46, at 127 (explaining that "the resulting payoff vector [would] be 'efficient' (i.e., that the payoffs add up to the worth of the grand coalition)").

[65] *Original Shapley Order*, *supra* note 11, at 13432.

[66] *See* Determination of Rates and Terms for Preexisting Subscription Services and Satellite Digital Audio Radio Services, *supra* note 10.

[67] *Original Shapley Order*, *supra* note 11, at 13433 n.35.

[68] *Id.* at 13442.

A. Gans Endorses Shapley Analysis

The first economic expert to respond was University of Toronto Professor Joshua Gans, who at the time was serving as a testifying expert on behalf of a coalition of copyright holders in *Phono III*.[69] At issue was the "mechanical license" that allows interactive streaming services to pay a regulated rate for the right to reproduce and distribute copyrighted musical works. The statute at the time required that the CRB set rates that were "reasonable" in light of four statutory objectives: (1) "maximize the availability of creative works to the public"; (2) "afford the copyright owner a fair return for his or her creative work and the copyright user a fair income under existing economic conditions"; (3) "reflect the relative roles of the copyright owner and the copyright user in the product made available to the public"; and (4) "minimize any disruptive impact on the structure of the industries involved."[70]

Professor Gans endorsed Shapley analysis for this purpose. Pointing to the CRB's decision from the year before, Gans took the position that "bargaining among interactive streaming services and multiple music rightsholders is exactly the type of bargaining problem that Shapley's solution is best suited to address."[71] He then cited the two primary papers that the CRB had itself cited: Shapley's original piece from 1953 and Professor Watt's paper from 2010. From there, Gans explained Shapley analysis in the familiar way. He noted that it "involves considering all the possible permutations of agreements to participate . . . that could result between the parties" and turns on "how the addition of a particular participant, in each particular sequence, adds to the combined surplus in each case."[72] He explained that those additions "represent the contributions made by each party in each permutation" and that the ultimate Shapley value for a party is that party's "average contribution made across all of the possible coalition permutations."[73]

Professor Gans proposed to evaluate rates by studying a four-player representation of the market, with one "[record] label" conceptualized as holding all the necessary rights to perform audio music, one "[music] publisher" conceptualized as holding all the necessary rights associated with words and notes, and two "services" conceptualized as competing providers of identical

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[69] *See Gans 2016*, *supra* note 12. Experts who file reports at the CRB are typically paid by the stakeholder who engaged them to do so. These relationships are typically disclosed explicitly in the relevant reports, for obvious reasons.

[70] *See* 17 U.S.C. § 801(b)(1) (prior to 2018 amendments).

[71] *Gans 2016*, *supra* note 12, at 32.

[72] *Id.* at 33.

[73] *Id.*

streaming technologies. Gans did not formally implement that model, however. For instance, he did not offer a chart showing the now-twenty-four possible Shapley permutations, nor did he calculate relative contributions under each of those theoretical alternatives. Instead, Gans simply pointed out that the Shapley value accorded to the publisher in his model would be identical to the Shapley value accorded to the label in his model, because, for the purposes of the model, there were no relevant differences between the two. Both copyright holders offered licenses that were essential; in the absence of either, streaming was simply not possible. "Ultimately," summarized Gans, "what we learn from this analysis is that in a hypothetical market where . . . royalties [are] negotiated with the aim of establishing a fair and efficient division of the surplus generated from music delivery via interactive streaming, publishers and labels would have the same ability to capture surplus. Their equal Shapley values would result in negotiated royalty rates that delivered equal profits to each."[74]

B. Marx Offers a Competing Shapley Model

One month later, Duke University Professor Leslie Marx filed an expert report in the same *Phono III* proceeding but on behalf of the streaming company Spotify.[75] Marx opened the relevant portion of her report with an anecdote reminiscent of my taxi example, hers about a "personal experience with the Shapley value."[76] While on a then-recent vacation, Marx and her family had apparently joined another family for a boat ride, and the group overall was able to save money by purchasing their tickets together. "There were four people in my family," wrote Marx, "five in the other family," and trips were priced such that the cost for Marx's family alone would have been $500, the other family alone would have been $600, but the nine people together was just $900.[77] "My family's contribution to cost [was] $500 if we go first and $300 if we go second, for an average of $400. The other family's contribution to cost [was] $600 if they go first and $400 if they go second, for an average of $500."[78] Thus, rather than splitting the bill 50/50, the two families followed the Shapley approach: Marx's family paid $400 and the other family paid $500. This solution, Marx explained, "embodies a notion

[74] *Id.* at 37.
[75] *See Marx 2016*, *supra* note 13.
[76] *Id.* at 51.
[77] *Id.*
[78] *Id.*

of fairness" and exemplifies the idea that "each party should pay according to its average contribution to cost or be paid according to its average contribution to value."[79]

Professor Marx then applied Shapley analysis to the questions at hand. Like Professor Gans, she acknowledged that the Judges themselves had suggested the use of Shapley analysis in a prior proceeding.[80] She also agreed that Shapley analysis was relevant, highlighting the second statutory factor, which aimed to offer "fair returns" to all parties, and the third factor, which focused on the "relative roles" of the parties in bringing the product to fruition.[81] She then offered a Shapley model with three players: a representative streaming service capable of offering the interactive type of streaming at issue in the proceeding; a generic "music distributor" capable of offering competing services like broadcast radio, satellite radio, and also noninteractive streaming services; and a representative copyright holder capable of licensing whatever rights those various streaming services and music distributors might need. Marx estimated Shapley values using this model and available data, and, in an appendix, she presented an alternative model where, instead of having one player represent all copyright holders, she used one player to represent all record labels and another player to represent all music publishers.

C. Rebuttals from Katz & Watt

Rebuttal reports followed a few months later. UC Berkeley Professor Michael Katz filed a responsive report on behalf of the streaming service Pandora.[82] He criticized Professor Gans's Shapley analysis, arguing that Gans made "unrealistic assumptions about the structure of the Shapley bargaining situation" in that Gans's model included two streaming services but only one of each type of copyright holder.[83] "[T]his structure tends to favor the hypothetical record company and publisher at the expense of the hypothetical streaming services," warned Katz, because the model's two streaming services "compete" whereas the two copyright holders both act as monopolistic

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[79] *Id.*

[80] *Id.* at 50 ("Following the Judges' suggestion, I use the Shapley value . . . .").

[81] *Id.* at 40 (explicitly linking Shapley analysis to the second and third 801(b) factors); *id.* at 50 (citing the 801(b) factors calling for "fair" allocations).

[82] *See* Corrected Written Rebuttal Testimony of Michael L. Katz, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), (Copyright Royalty Bd. Feb. 15, 2017) [hereinafter *Katz 2017*].

[83] *Id.* at 105.

suppliers.[84] Katz also warned that, by treating all songwriters as a single "publisher" in the model, Gans had failed to account for the reality that "songwriters clearly have widely varying talent levels" and thus likely would, in a traditional market, be accorded varying shares of any available profits.[85]

Professor Katz's most significant criticisms, however, targeted an inconsistency between the scope of the CRB proceeding and the scope of the Gans model. In the model, the allocation of streaming revenues was fully up for debate. Gans was free to calculate the amount allocated to the streamers, the amount awarded to the record labels for sound recording rights, and the amount assigned to the music publishers for musical work rights. The CRB proceeding, by contrast, was exclusively about fees that would be paid to the music publishers: the CRB's job was to set the rates that interactive streamers would pay to music publishers for a specific government-authorized compulsory license. So what happens, Katz wondered, when the Gans model is premised on a given distribution of money as between the streamers, the record labels, and the music publishers, but in the real world some of those participants receive more, or less? As Katz made clear, the CRB lacked the power to actually rebalance cash flows by taking money away from the record labels and giving it to either the streamers or the music publishers. Instead, the CRB only had the power to impose one Shapley value (for the music publishers) and then hope that market forces would somehow deliver the remaining two.[86]

University of Canterbury Professor Richard Watt also filed a rebuttal report, building on his own prior paper, writing on behalf of a coalition of copyright holders, and responding to Professor Marx's filing.[87] Watt's academic paper had endorsed Shapley analysis as a "fair and equitable" approach to revenue allocation;[88] and, consistent with that view, his report described Shapley analysis as a "very appropriate methodology" that is "ultimately designed to model the outcome in a hypothetical fair market environment."[89] Watt nevertheless objected to nearly all of Professor Marx's modeling choices. For example, he complained that her model inappropriately included only one streaming service, thereby failing to account for the competition that takes place as streamers jockey for subscribers and compete for negotiated

[84] *Id.* at 107–08.
[85] *Id.* at 111.
[86] *Id.* at 118–25.
[87] *See Watt 2017*, *supra* note 14, at 13.
[88] Watt, *supra* note 62, at 35.
[89] *Watt 2017*, *supra* note 14, at 11–12.

copyright relationships.[90] At the same time, he characterized as "irrelevant" the radio stations, satellite radio providers, and other music distributors that Marx had included in her model, arguing without much explanation that it was "illegitimate" to include in the Shapley construct distributors other than the specific ones whose rates were actually at issue in the proceeding.[91]

D. The CRB Accepts Shapley Analysis

Hearings, additional reports, and other briefing finally culminated in 2019 with a "final determination"[92] that the D.C. Circuit would later describe as "relying primarily"[93] on Shapley analysis. The Judges took Professor Marx's upper estimate of the rate that ought be paid for the mechanical license under a Shapley approach and used it as the lower bound for their final range.[94] They took the lowest estimate from Professor Watt's Shapley analysis and used that as their upper bound.[95] And they explicitly adopted Professor Gans's "assumption of equal Shapley values" between record labels and music publishers, which they described as "informative" and "reasonable."[96] Nearly every party involved in the proceeding appealed the decision to the D.C. Circuit, with the main objection being that the CRB arguably had failed to provide adequate notice of the rate structure it ultimately adopted.[97] No party, however, meaningfully challenged the relevance or reliability of Shapley analysis

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[90] *Id.* at 12–13 ("Therefore the appropriate modelling assumption for correctly capturing the reality of the interactive streaming industry, and the essence of the standard Shapley model itself, is to separate the interactive streaming companies out as different individual players.").

[91] *Id.* at 13–14 ("Another methodological flaw in the way Dr. Marx has carried out her analysis is in the inclusion of irrelevant players . . . [that] will in turn condition and distort the Shapley values of the other players who should legitimately be in the model.").

[92] *See Phono III Order*, *supra* note 16.

[93] Johnson v. Copyright Royalty Board, 969 F.3d 363, 372 (D.C. Cir. 2020).

[94] *Phono III Order*, *supra* note 16, at 1954 ("Consequently, the Judges view Professor Marx's top value for total royalties . . . to constitute a lower bound for total royalties in computing a royalty rate.").

[95] *Id.* ("The Judges give [Professor Watt's royalty figures] weight only to the extent of viewing his lowest figure . . . as an upper bound for total royalties in computing a royalty rate.").

[96] *Id.* at 1951.

[97] *See Johnson,* 969 F.3d at 363 (evaluating the various parties' appellate contentions).

per se, as nearly every stakeholder had sponsored an economic expert who had endorsed or at least used it.

E. Shapley Introduced in New Proceedings

Shapley analysis meanwhile continued to gain traction at the CRB. In 2019, the CRB opened a proceeding—*Web V*—to set rates for the compulsory license that allows noninteractive streaming services to reproduce and perform copyrighted sound recordings.[98] The applicable legal standard this time required that the Judges set the rates and terms that "most clearly represent the rates and terms that would have been negotiated in the marketplace between a willing buyer and a willing seller," with special emphasis on the "relative roles of the copyright owner and the transmitting entity . . . with respect to relative creative contribution, technological contribution, capital investment, cost and risk."[99] Yet, even under this standard—one that did not explicitly call for "fair" rates and hence could easily have been read to require other sorts of analysis and evidence—Shapley analysis again took center stage. The central report this time was filed by Princeton University Professor Robert Willig on behalf of a coalition of copyright holders.[100] Acknowledging the CRB's prior reliance on Shapley analysis, Willig declared that "Shapley Values are an appropriate tool for assessing rates that would be negotiated in the hypothetical marketplace for noninteractive webcasting."[101]

Willig explained Shapley analysis in the now-familiar way. "Shapley Values are a generalized solution to the problem of how to apportion among the members of a multi-party bargaining group the surplus created by their productive cooperation with each other," he wrote, citing Shapley's original paper, a 2002 summary of that paper, and a few pages from a microeconomics textbook.[102] "This solution divides up the surplus according to each party's

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[98] *See* Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate Those Performances (Web V), *supra* note 43. As the name implies, this one proceeding considered rates for two licenses that noninteractive streamers need: the right to publicly perform copyrighted sound recordings, and the right to make temporary "ephemeral" copies of those sound recordings in support of the licensed performances. *See supra* notes 24–26 and accompanying text.

[99] 17 U.S.C. § 114(f)(1)(B).

[100] *See Willig 2019*, *supra* note 15.

[101] *Id.* at 37.

[102] *Id.* at 6.

incremental contributions to the total amount of value created."[103] In Willig's model, there were six players. Three represented the "Big Three" record labels, companies that together control nearly all of the recorded music that listeners expect to hear on a streaming service.[104] Willig modeled those players as essential to viable streaming; in the model, until a streamer had licenses with all three, the streamer could not offer service. A fourth player represented "independent" record labels, modeled as record labels that add value but are not essential to and cannot alone support a viable service. The last two players were a representative ad-supported noninteractive streaming service and a representative subscription noninteractive streaming service.

Three months later—and before the CRB could evaluate Willig's proposals—the D.C. Circuit remanded *Phono III* for further proceedings, holding that the Judges had "failed to provide fair notice of the rate structure" adopted in their "final" order, a rate structure that had not been explicitly advanced by any party.[105] The CRB thus reopened the *Phono III* record. In parallel, the CRB opened yet another rate-making proceeding, *Phono IV*, this one meant to set rates for the same license that was at issue in *Phono III* but applied to the years 2023 through 2027.[106] Adding complexity, an intervening act of Congress had changed the legal standard applicable to *Phono IV*, replacing the four factors that were central to *Phono III*[107] with a "willing buyer, willing seller" standard akin to the one already in place for *Web V*.[108]

These overlapping proceedings led to a flood of additional economic testimony, with Shapley analysis still pervasive. Professor Watt, for example, filed new reports in both the *Phono III* remand[109] and the new *Phono IV*

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[103] *Id.*

[104] Universal Music Group, Warner Music Group, and Sony Music Entertainment have long been the three largest record labels operating in the United States. Universal controls roughly 30% of the market, Warner roughly 20%, and Sony roughly 15%. *See* Amended Corrected Written Direct Testimony of Joseph Farrell, D.Phil., Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV) at 27 (Copyright Royalty Bd. Mar. 8, 2022) [hereinafter *Farrell*] (reporting market shares based on data from 2017 and 2019).

[105] Johnson v. Copyright Royalty Board, 969 F.3d 363, 380–83 (D.C. Cir. 2020).

[106] *See* Phonorecords IV, *supra* note 42.

[107] *See supra* note 70 and accompanying text (citing and quoting the prior standard).

[108] 17 U.S.C. § 115(c)(1)(F). For discussion of the change, *see* Abowd, *supra* note 28.

[109] *See, e.g.*, Remand Written Rebuttal Testimony of Richard Watt (Ph.D.), Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III) (Copyright Royalty Bd. July 2, 2021).

proceeding,[110] again on behalf of a coalition of copyright holders. He continued to champion Shapley analysis even under the new, no-mention-of-fairness-this-time *Phono IV* standard. The Shapley approach, he wrote in a *Phono IV* filing, is "once again . . . a natural choice, both for setting a rate that is acceptable under a mantra of willing buyer/willing seller, and for setting a rate that reflects effective competition."[111] "There is no other economic tool that delivers a sharing rule that captures relative contribution and costs as aptly as Shapley modelling."[112] While a range of rates would "satisfy the criteria of enticing the players to voluntarily participate"[113] in the transactions at hand, he argued, Shapley values are "perhaps the most appropriate result"[114] because they "reflect the values that economists believe generally underlie fair marketplace transactions for all market participants."[115] According to Watt, the Shapley "sharing rule more clearly represents a willing buyer/willing seller outcome than other approaches" because it "removes" any opportunity for "strategic play" and other types of market abuse.[116] "There is simply no space in the Shapley model for any player to manipulate the payoffs to their advantage in any way that is not fully representative of their own (and only their own) contribution to the shareable surplus. Therefore, it is quite evident that the model is perhaps the purest representation of what we might understand by effective competition."[117]

Professor Marx returned in both *Phono IV* and the *Phono III* remand as well, testifying for Spotify in the *Phono III* remand[118] and for Amazon in *Phono IV*.[119] Although her model had been relied upon by the Judges in their

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[110] *See, e.g.*, Written Direct Testimony of Richard Watt (Ph.D.), Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV) (Copyright Royalty Bd. Oct. 13, 2021) [hereinafter *Watt 2021*].

[111] *Id.* at 9.

[112] *Id.* at 12.

[113] *Id.* at 9.

[114] *Id.*

[115] *Id.* at 11.

[116] *Id.* at 11–12.

[117] *Id.* at 14.

[118] *See, e.g.*, Written Second Supplemental Remand Testimony of Leslie M. Marx, PhD, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), (Copyright Royalty Bd. Jan. 24, 2022) [hereinafter *Marx Jan 2022*]; Written Supplemental Rebuttal Remand Testimony of Leslie M. Marx, PhD, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), (Copyright Royalty Bd. Feb. 24, 2022) [hereinafter *Marx Feb 2022*].

[119] *See, e.g.*, Amended Written Direct Testimony of Leslie M. Marx, PhD, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV) (Copyright Royalty Bd. March 8, 2022).

pre-remand *Phono III* calculations, Marx on remand clarified that she did not mean for her model to be used in that way: "As I discussed in my original testimony," she wrote, "the Shapley model, when appropriately implemented, can provide insights about the directional change for fair royalty rates relative to current values," but "the rates that emerge from a Shapley analysis are not market rates, competitive or otherwise."[120] In another filing, she emphasized that the "fundamental problem"[121] with the original *Phono III* determination was the one that Professor Katz had also highlighted:[122] "record labels earn far more in the real world than the [Judges'] Shapley value analysis would allocate to them," resulting in a situation where, because there is only so much money to go around, music publishers and streaming services "will necessarily earn less" than their Shapley values.[123]

Yet another expert who filed a report speaking to these issues was Professor Katz, who submitted on behalf of Pandora in the *Phono III* remand[124] testimony that was designated for use in *Phono IV* as well.[125] Katz warned that "the outcome of a Shapley analysis can starkly fail to correspond to the outcome of an effectively competitive market."[126] Katz also complained that Professor Watt in particular had cited "no economic literature in support of his claim" that Shapley analysis can be used to mitigate the effects of market power.[127] UC Berkeley Professor Joseph Farrell, meanwhile, submitted testimony in *Phono IV* on behalf of Spotify.[128] He cautioned that the *Phono III* Shapley methodology "would not be appropriate" for determining rates under *Phono IV*'s "standard of effective competition."[129] The economist Gregory Leonard,

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[120] *Marx Jan 2022*, *supra* note 118, at 4.

[121] *Marx Feb 2022*, *supra* note 118, at 6.

[122] *See Katz 2017*, *supra* note 82 and accompanying text.

[123] *Marx Feb 2022*, *supra* note 118, at 6–7.

[124] *See, e.g.*, Written Direct Remand Testimony of Michael L. Katz, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III) (Copyright Royalty Bd. Apr. 1, 2021) [hereinafter *Katz 2021*]; Written Supplemental Rebuttal Remand Testimony of Michael L. Katz, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III) (Copyright Royalty Bd. Feb. 24, 2022) [hereinafter *Katz 2022*].

[125] *See* Introductory Memorandum to the Written Rebuttal Statement of Pandora Media LLC, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV) at 2 (Copyright Royalty Bd. Apr. 26, 2022) (designating the earlier testimony).

[126] *Katz 2021*, *supra* note 124, at 26.

[127] *Katz 2022*, *supra* note 124, at 5.

[128] *See, e.g.*, *Ferrell*, *supra* note 104.

[129] *Id.* at 87.

too, urged caution. Writing for Google in *Phono IV*, he documented a range of concerns with the Shapley approach, concluding in the end that "replacing the Shapley construct with an entirely different model of competition . . . may be needed to appropriately model effective competition."[130]

The CRB never had the chance to address these issues in *Phono IV*; in 2022, the parties announced an industry-wide settlement.[131] *Web V* did result in an issued rate determination, but the Judges there largely rejected Professor Willig's analysis, finding that his approach—modeling each of the Big Three record labels as absolutely essential to any viable streaming service—did not "reflect effective competition" because it accorded significant market power to those three rightsholders.[132] In June 2023, however, the Judges released their final decision in the *Phono III* remand, and there they again endorsed Shapley analysis, at least as to the four-factor test still applicable to the *Phono III* remand.[133] The Judges interpreted the D.C. Circuit's decision as narrowly authorizing them to reconsider only a handful of specific issues.[134] That said, when evaluating the streaming services' argument that the *Phono III* Shapley analysis needed further refinement, the Judges wrote that "even if" the appellate court decision were "construed as permitting the Judges to revisit" the question of whether Shapley values comport with the *Phono III* requirements that the statutory rate accord "fair returns" to all parties and account for their "relative roles" in bringing about the final consumer product, the Judges "would not adjust" their conclusions because doing so would be "substantively unwarranted."[135] Thus, the Judges again used the models presented by Professors Watt and Marx to establish a potential royalty range; and, as for Professor Gans, the Judges in the post-remand *Phono III* decision did "not

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[130] Written Rebuttal Testimony of Dr. Gregory K. Leonard, Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV) at 96 n.246 (Copyright Royalty Bd. Apr. 22, 2022).

[131] *See* Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords IV), 87 Fed. Reg. 80448, 80448–53 (Copyright Royalty Bd. Dec. 30, 2022) (summarizing and approving proposed settlement).

[132] Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate Those Performances (Web V), 86 Fed. Reg. 59452, 59539 (Copyright Royalty Bd. Oct. 27, 2021) ("Thus, because the royalty rates derived from Professor Willig's Shapley Value Model reflect complementary oligopoly power . . . they must be discounted to reflect effective competition.").

[133] *Phono III Remand*, *supra* note 16, at 54410–48 (repeatedly finding no reason to adjust the Board's original Shapley analysis on remand).

[134] *See, e.g.*, *id.* at 54414 (noting that the remand "unambiguously affirmed" and "did not disturb" various critical findings).

[135] *Phono III Remand*, *supra* note 16, at 54414.

find cause to reconsider [the prior decision's] adoption of Professor Gans's Shapley-inspired analysis," specifically including his "assumption of equal Shapley values" for the two necessary copyright rights.[136]

IV. Rejecting Shapley Analysis

Copyright licensing could have been left entirely to the unregulated market. Records labels and music publishers would, in that scenario, have negotiated directly with interactive and noninteractive streamers.[137] Traditional market forces would have defined the necessary terms and shaped the necessary rates. Congress created a system of compulsory licenses, however, and from that the economists who filed expert reports in *Phono III*, *Phono IV*, and *Web V* all seemed to reasonably infer that the CRB is supposed to do something more than simply recreate market outcomes. The economists did look to the market for information about plausible rates, incentives, and behavior. But they each urged the CRB to deviate from those actual or hypothetical market results in order to address one or another specific market imperfection.

Some of the economists worried about market power. Professor Marx, for instance, championed adjustments to offset what she perceived to be the undue leverage enjoyed by copyright holders due to concentration in the music industry.[138] Others worried about imperfect information. Professor Watt, in this spirit, argued that copyright holders face a considerable challenge when negotiating with firms like Apple or Amazon because, to an unknown degree, these firms use streaming to drive business to other products and services.[139] The economists also picked up on a related issue that Congress had flagged: streaming simultaneously promotes and substitutes for other types of music consumption, which poses a problem given how little

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[136] *Id.* at 54417, 54417 n.53.

[137] In truth, I suspect that, in a truly well-functioning market, record labels and music publishers would first negotiate with one another, and then together offer streamers the one permission streamers truly need: the integrated right to include a song's words, notes, and sounds in their relevant music catalog. The current system is much more stilted in that it artificially separates negotiation over the musical work from negotiation over the sound recording.

[138] *See Phono III Order*, *supra* note 16, at 2022 (explaining this portion of Marx's analysis).

[139] *See Watt 2021*, *supra* note 110, at 7–8, 60–61 (discussing technology companies' alleged market power and the "information asymmetry" presented by the interrelationships between their music and non-music offerings).

data is available by which to quantify either the benefits or the harms for (say) concert revenue and direct CD sales.[140]

These are all valid concerns, in my view, each warranting thoughtful exploration. But Shapley analysis does not speak to any of them. Start with the claim that Shapley analysis can be used to model "market" interactions. This is a foundational, explicit, descriptive claim for Professors Gans, Watt, and Willig, and they each use it to justify Shapley analysis as a framework for answering all of the other open questions. Professor Gans, for instance, asserted in his original 2016 filing that Shapley analysis can be used to estimate the royalties "that would prevail in an unconstrained *market*."[141] Professor Watt wrote in 2017 that Shapley analysis "mimics what a free and unrestricted *market negotiation* would yield"[142] and followed up in 2021 with the assertion that that the Shapley methodology "reflects effective *competition*."[143] Professor Willig similarly assured the Judges in 2019 that "Shapley Values are an appropriate approach for assessing rates that would be negotiated in the hypothetical *marketplace* . . . ."[144]

But how can these descriptions possibly be true? Consider Professor Gans's first filing. Gans was the first economist to take seriously the CRB's suggestion that Shapley analysis be used as a framework for rate-setting at the CRB, so he understandably opened the relevant portion of his report with an example designed to teach the basic operation of Shapley mathematics. His example involved three firms selling gloves.[145] Two each produced a single right glove, and one produced a single left glove. The surplus generated from matching left with right was defined to be $1, and there was no value associated with an unpaired glove. Professor Gans articulated the familiar Shapley process where all possible coalitions of glove providers "arrive" in all possible orders. And he concluded that each provider of a right glove should be assigned a Shapley value of one-sixth of a dollar, whereas the lone provider

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[140] *See* 17 U.S.C. § 114(f)(1)(B)(i)(I) (requiring the Judges to consider "whether use of the service may substitute for or may promote the sales of phonorecords or otherwise may interfere with or may enhance the sound recording copyright owner's other streams of revenue from the copyright owner's sound recordings"). Omitted from the list but surely also relevant: music streaming likely benefits copyright holders by obviating some of the incentive to engage in music piracy. Measuring that effect, of course, would be tricky, too.

[141] *Gans 2016*, *supra* note 12, at 31 (emphasis added).

[142] Watt 2017, *supra* note 14, at 15 (emphasis added).

[143] Watt 2021, *supra* note 110, at 9 (emphasis added).

[144] *Willig 2019*, *supra* note 15, at 12 (emphasis added).

[145] *Gans 2016*, *supra* note 12, at 35–36.

of the left glove should be accorded a higher Shapley value of two-thirds of a dollar. Gans explained that the provider of the lone left glove "commands a higher share of the surplus because she is the only player to own a left glove," whereas the two providers of potential right gloves "are substitutes for one another" and hence compete away some of the value that a lone right glove owner would otherwise receive.[146]

This model bears no resemblance to any real-world market. In any plausible market, after all, one of the two right glove proprietors would consummate the deal and earn a return, while the other would be left with no deal and earn nothing. That risk would in turn play a critical role in the real interaction, in that it would motivate competition between the two companies, with each trying to undercut the other's price for fear of otherwise ending the interaction (sorry) empty-handed. But there is no real-world market where, after one transaction, both right glove sellers are nevertheless paid. And there is certainly no real-world market where the successful seller and the unsuccessful competitor both earn the exact same return.

Professor Gans nevertheless leapt from that implausible example to the real issue that was then before the CRB. He acknowledged that the "usual intuition" is that competing parties "can be played off against one another to effectively be pushed to receiving payments close to their costs, earning no surplus"; but he asserted that the Shapley value approach instead "predicts" (predicts?) instead an outcome where all competitors are paid.[147] Gans then offered a just-so story that could have been used to justify almost any values he might have proposed. His story focused on the potential for "left glove" copyright holders to pit "right glove" technology companies against one another in a bidding war. He announced that copyright holders would do no such thing. Because streaming services "have a role in providing competition against one another," he explained, copyright holders "will not push these streamers to their limits in negotiation" but will instead leave precisely the Shapley value on the table, using that exact amount to strategically keep one streamer "waiting in the wings" as a competitive check on the other.[148]

Professor Marx filed the next report to seriously consider Shapley analysis, and she similarly implied that Shapley analysis can do much more than identify a "fair" allocation of some specific shared gain or loss. Marx was concerned that copyright holders might have "concentrated market power" given industry consolidation. She knew that a simple Shapley model would

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[146] *Id.* at 35.
[147] *Id.* at 36.
[148] *Id.*

do nothing to mitigate that distortion, so she presented a model where she "intentionally elevated the market power of the [streaming] services"[149] by using a single player to represent all interactive streamers rather than modeling each existing streamer separately. As she explained in live testimony, her intent was to offset copyright holders' market power by introducing market power on the other side of the transaction. But that was another just-so adjustment, one that shifted the numbers in the desired direction, sure, but did so to a completely arbitrary degree. Shapley mathematics offered no insight into the extent of the original market distortion. The Shapley dynamic neither suggested nor validated Marx's attempt to offset it. And of course it didn't, because Shapley models are not models of market behavior.

A. Model Ambiguity and Stakeholder Incentives

The taxi example makes these problems even more plain. Admittedly, that example is a significant simplification of Lloyd Shapley's original, sophisticated model, and it pales in comparison to the mathematical extensions that have been developed since. But simplicity lays bare the actual workings of a model, and, here, two fundamental elements make Shapley analysis plainly inappropriate for the CRB's purposes. First, Shapley's structure leaves no room for ambiguity as to how many and which specific parties ought to be considered legitimate stakeholders. Three riders are relevant to the taxi example. There is no mechanism by which to explore whether Ann and Bob should be counted as a single passenger because they are dating, or whether Chris should count double because he is bringing along heavy luggage. There are three riders; that fact leads to a chart with six possible payment orders; and the addition or subtraction of even one rider would significantly alter every calculation. Second, Shapley analysis is unapologetically static, with no room for players to engage in strategic behavior and no accounting for the long-run incentives created by the model's proposed allocations.[150] Chris in the taxi example cannot negotiate a better deal by credibly threatening to ride alone. Alice and Bob cannot tweak their allocations even if they realize that, at these numbers, Chris will next time choose a restaurant closer to his home or opt to drive his own car.

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[149] *Phono III Order*, *supra* note 16, at 2022 (explaining Professor Marx's testimony).

[150] Presumably this is what the Judges were meaning to criticize when they rejected Shapley analysis in their 2006 Order. *See* Determination of Rates and Terms for Preexisting Subscription Services and Satellite Digital Audio Radio Services, *supra* note 10 and accompanying text.

Note that these are not criticisms of the Shapley approach per se. Quite the opposite, Shapley analysis largely resonates in the taxi example, in that friends often find themselves in interactions where the number and identity of the participants is given and where strategic play is unlikely because it would violate powerful social norms. That is, when friends share a taxi, split a restaurant bill, or—Professor Marx's intuitive example[151]—share a boat ride, they very plausibly are looking for a static "fair" outcome by which they will then non-strategically abide. In rate-setting, by contrast, none of that holds true.

Consider, in this light, the definitional questions about who the relevant stakeholders are, how many of them will share in any allocation, and thus implicitly what monies ought be deemed eligible for division. Again, those questions all have obvious answers in the taxi example. Amy, Bob, and Chris are the only riders. The total taxi fare is the only number in play. In *Phono III*, *Phono IV*, and *Web V*, by contrast, these same questions were the subject of real and plausible dispute. Professors Gans, Watt, Marx, Katz, and Willig vigorously disagreed about whether copyright holders should be represented in the various models as a single unified rightsholder; as one representative record label and one representative music publisher; or as some larger number of separate players each representing a real-world record label, a real-world music publisher, and possibly even a real-world singer, musician, producer, or songwriter. Professors Gans, Watt, Marx, Katz, and Willig disagreed, too, on the question of how best to represent the streaming services. Professor Marx, for instance, argued that an appropriate Shapley model would include not just some number of players representing the streaming services but also some number of additional players standing in for other types of distribution partners who also contribute to the overall market for music.[152] Her intuitive point was that a "fair" allocation of copyright royalties can only be made by considering all the ways the implicated copyrights and the implicated streaming technologies interrelate. Professor Watt thought this approach flawed, agreeing that other types of music monetization are relevant but asserting that substitution and promotion across platforms should be measured in other ways.[153]

Whatever the right answer, these are critical inputs to Shapley analysis in that they significantly impact Shapley math. Consider a Shapley model where

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[151] See *supra* note 75 (discussing this aspect of the Marx report).

[152] *See Marx 2016*, *supra* note 13, at 54–55.

[153] *See supra* note 90 and accompanying text (discussing this aspect of the Watt report).

a painter, a decorator, and a furniture maker can potentially team together to modernize an apartment. For simplicity, ignore costs. If modernization generates $120 in value but can only be accomplished through the combined efforts of all three players, the Shapley procedure will allocate $40 in value to each. Redefine the model so as to require a fourth necessary player, such as a real estate agent to market the finished apartment, and in response the Shapley algorithm will reduce payments to $30 per player. Redefine the model again such that the painter is newly conceptualized as a lead painter and two assistant painters, all necessary, and now the Shapley values drop to $20 for each painter, $20 for the decorator, $20 for the real estate agent, and $20 for the furniture maker. Make another change—for example, frame the model such that any one of the three painters can do the entire job alone—and the Shapley values again shift considerably, this time with each painter being accorded $10 while every other skilled contributor earns $30. Shapley models, in short, are extremely sensitive to the assumed number and types of players included. And at the CRB, in sharp contrast to the taxi example, those values are significantly vulnerable to both strategic advocacy and genuine dispute.

Just to be clear, my concern here is neither the generic concern that a model's inputs drive its outputs nor the generic concern that models inevitably must approximate reality, rather than completely capture it. My concern is that Shapley models are particularly sensitive to their inputs, and hence this modeling approach is unreliable when those inputs are disputed, significantly stylized simplifications. So, while a Shapley model might have much to teach when the parties being modeled are the members of Professor Marx's family[154] or voting members of a governmental institution like a court or legislature—remember, that was the first practical application Lloyd Shapley himself pursued[155]—the Shapley approach is significantly less reliable where, as here, the real-world cast is much larger, much more diverse, and in countless ways intertwined.[156]

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[154] *See supra* notes 77–79 and accompanying text (discussing this aspect of the Marx report).

[155] *See* Shapley & Shubik, *supra* note 52.

[156] Worse, in these markets, the real-world cast is itself not stable, nor is it exogenous to CRB decision-making. The music industry regularly experiences changes relevant to the CRB's models, with parties entering and exiting the market as music publishers merge, new technologies offer new paths from artist to consumer, and so on. Moreover, as CRB rates change, those changes can themselves drive further industry restructuring, perhaps pressuring smaller rightsholders to consolidate or encouraging more meaningful integration between streamers and rightsholders. Again, none of that is even considered in the various Shapley models that have been

Turn next to the even more problematic point, that Shapley's model is completely static. Copyright law is an incentive system, recognizing in authors certain exclusive rights in order "to promote the progress of Science and useful Arts."[157] That process is intentionally dynamic. The whole idea is to inspire strategic responses from (say) singers, songwriters, musicians, producers, record labels, music publishers, and, yes, streaming services, technology companies, and listeners, too. All of these stakeholders are supposed to calibrate their actions in response to the returns they expect to receive, the fees they expect to incur, and the rights and privileges they otherwise expect to enjoy. To use an allocation mechanism that fully ignores dynamic implications is to study movement using a single photograph. Allocations cannot plausibly meet the statutory requirements of being "fair" and "reasonable"—let alone efficient or consistent with any plausible legislative purpose—if they are being made while blind to the bigger dynamics that are core to the underlying legal rule.

Further, even if it were somehow appropriate to allocate copyright monies without regard to long-run incentives, static analysis would still be inappropriate in this context because, while CRB analysis might be static, the copyright marketplace is not. In *Phono III*, for example, the Judges used Shapley analysis to establish what was intended to be a "fair" allocation of monies as between the interactive streaming services, the record labels, and the music publishers. The CRB's ruling was based on its view as to how much money each stakeholder ought to in fairness retain. But the proceeding itself established only the rate due to music publishers for the mechanical right. The ruling did not constrain what record labels could charge for the performance right, for instance, and indeed the CRB had no power to do so,

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presented to the CRB, each of which adopted an idiosyncratic simplified representation of the industry as it existed at the time that particular model was proposed.

[157] These words come directly from Art. 1, § 8, cl. 8 of the U.S. Constitution, which is the clause that empowers Congress to create both the copyright and the patent regimes. Courts interpret this language in the broad way I summarize, emphasizing that the goal is not merely to reward authors, but more richly to incentivize authors, users, and all the other stakeholders who collectively create, enjoy, distribute, learn from, and otherwise use creative work. Thus, for instance, the Supreme Court has explained that copyright must not only "assure[] authors the right to their original expression" but must also "encourage[] others to build freely upon the ideas and information" contained therein. Feist Publications, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 349 (1991). And the Court has likewise explained that "copyright law is an exercise in managing the tradeoff" between protecting artistic accomplishments and encouraging technological innovation. MGM Studios Inc. v. Grokster, Ltd., 545 U.S. 913, 928 (2005).

even had it tried. The record labels were thus immediately free to react to the CRB's rate by charging whatever license fees the market would bear, even if that number was higher than the CRB's calculated amount, and even if paying it meant that streamers would end up with less money than the CRB intended.[158] For this reason, too, Shapley analysis falters in this application. If the Shapley value assigned to music publishers is appropriate at all, it is appropriate conditional on record labels and streaming services also being accorded their Shapley values. In the real world, however—because the CRB has power over only a subset of the relevant rights and a subset of the relevant parties—those Shapley values exist on paper only.

B. The Equivalence Assumption

That so many testifying experts urged the CRB to adopt Shapley analysis despite these many shortcomings is jarring. More jarring, still, is the way the analysis was actually implemented in those economic reports. Remember, in *Phono III*, Professor Gans championed a particular ratio of royalties, concluding that "what we learn" from Shapley analysis "is that in a hypothetical market where licensing of composition and sound recording rights were equally unconstrained" and "royalties were negotiated with the aim of establishing a fair and efficient division of the surplus generated from music delivery via interactive streaming," record labels and music publishers would earn the same profit.[159] Professor Marx developed a competing and more detailed model where she endeavored to "equalize market power as between Copyright Owners and the streaming services" and then she, too, used Shapley analysis to calculate a royalty ratio.[160] Professor Watt, meanwhile, filed a rebuttal report, criticizing Professor Marx's analysis, adjusting various estimates, but presenting his own Shapley ratio. The Judges in both their pre-remand and post-remand determinations amalgamated the three approaches, endorsing Professor Gans's ratio as "informative" and then defining a "zone

[158] This problem led the CRB to reject part of its own *Phono III* decision when it revisited these issues in light of the court-ordered remand. *See Phono III Remand*, *supra* note 16, at 54431 (acknowledging that, in the original decision, "the Majority [wrongly] took comfort in what it understood to be Professor Watt's 'prediction' that increases in mechanical royalties would be offset almost dollar-for-dollar by reductions in the sound recording royalty").

[159] *Gans 2016*, *supra* note 12, at 37.

[160] *See Phono III Order*, *supra* note 16, at 1950 (describing the Marx approach).

of reasonable rates" that used Professor Marx's highest estimate as the lower bound and Professor Watt's lowest estimate as the upper bound.[161]

Driving all of that analysis, however, was what turns out to be an indefensible assumption. Professor Gans's version was the most explicit. When defining his Shapley model, Gans explained that "while players may vary widely in the value they contribute to the coalition, they can be divided into one of two general categories, veto players and non-veto players."[162] Veto players, in his vernacular, were the essential participants to any deal, such that "coalitions to which the veto player is not a member necessarily have no value."[163] Gans had one record label and one music publisher in his Shapley model, and, because "both the record company and the publisher must agree to any negotiated deal" in order for any music to be streamed, Gans modeled both as veto players.[164] In the math, this meant that the two types of copyright holders were almost indistinguishable. They each had the same binary effect on every calculation; until both had licensed a given streaming service, that streaming service could not operate. Gans thus determined, directly because of this assumption, that the two would have "equal Shapley values" and hence should be awarded "royalty rates that delivered equal profits to each."[165]

Professor Marx imposed an equivalence assumption, too, although in her case perhaps inadvertently. In her most relevant model, there was one music publisher, one record label, one interactive streaming service, and one stand-in for every other type of music distributor. Marx articulated the Shapley interaction mathematically,[166] and that math quietly built in what Gans had explicitly stated: no value could be created unless both the one record label and the one music publisher licensed their rights. Record labels and music publishers were therefore indistinguishable to Marx just like they were

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[161] *See id.* at 1951 (characterizing Gans's analysis as "informative"); *id.* at 1954 (using Marx's and Watt's analysis to define a "zone of reasonable rates"); *Phono III Remand*, *supra* note 16, at 54417 (reaffirming the prior conclusion with respect to Professor Gans); *id.* at 54412 (reaffirming the prior analysis with respect to the zone of reasonable rates).

[162] *Gans 2016*, *supra* note 12, at 34.

[163] *Id.* at 34.

[164] *Id.* at 36.

[165] *Id.* at 37.

[166] *See Marx 2016*, *supra* note 13, at Appendix B-7. Marx labelled the music publisher U1, the record label U2, the interactive streamer I, and the catch-all distributor O. She then implicitly modeled the copyright holders as veto players, writing that "the only combinations that create positive values are {U1, U2, I, O}, {U1, U2, I}, and {U1, U2, O}."

indistinguishable to Gans. Sound recording copyright holders and musical work copyright holders were accorded the same share of profit because there was no basis on which to do anything else.

Professor Watt's rebuttal report followed suit. He had significant objections to what he perceived as the "important methodological and data flaws" in Professor Marx's report.[167] And he emphasized that the "very essence of the Shapley methodology is to bring to the forefront what each player contributes to the total net surplus."[168] But, when it came to crafting his own model, he joined Professors Gans and Marx in the view that music publishers and record labels are in this context equally crucial. As he wrote, "Each of the two groups of copyright holders supplies an essential input to the market" and those "inputs are perfectly complementary."[169] "It is therefore acceptable that the copyright holders be modelled as a single player," he concluded, a modeling decision that obviously would in no way challenge the equivalence built into the Gans model and the Marx math.[170]

But music publishers and record labels do not plausibly contribute the same value. Yes, once a song is recorded, the only way to legally stream it is to license both the audio itself and the underlying words and notes. From that perspective, the sound recording copyrights held by record labels on behalf of performing artists are indistinguishable from the musical work copyrights held by music publishers on behalf of songwriters. Both rights are necessary. Both rightsholders in that framing understandably earn identical Shapley payoffs.

Shift perspective to consider how songs come into existence, however, and binary equivalence falls apart. Before a song is recorded, songwriters and their representatives negotiate with singers and their representatives to decide whether any given song will be recorded in the first place, by whom, and how any resulting royalties and rights will be shared.[171] This is perhaps the most competitive part of the music ecosystem. After all, if a given singer demands too much money or too much control, the songwriter can bring the song at issue to some other singer. Likewise, if the songwriter demands too much money or too much control, the singer can opt to record some other song or even write their own.

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[167] *Watt 2017*, *supra* note 14, at 2.
[168] *Id.* at 12.
[169] *Id.*
[170] *Id.*
[171] *See* Jason Blume, Six Steps to Songwriting Success (2nd ed. 2008); Jason Blume, This Business of Songwriting (2nd ed. 2013).

This push-and-pull not only defines the universe of songs that are ultimately available for streaming, but also defines the relative value of the implicated musical work and sound recording copyrights. The more a given songwriter values a given singer as compared to the next-best option, the more generous the songwriter will be in assigning value to the sound recording during this critical negotiation. The more a singer values a given song as compared to the next-best option, the more generous the singer will be in assigning value to the musical work during this same conversation.

The CRB, however, was presented with a set of models where singers and songwriters were assumed to make equal contributions to the creation of recorded music. Each model shares the same core conceit: that record labels and music publishers bring the same value to the table because they both waive a potential legal veto. But that is a remarkably incomplete way of conceptualizing the very differentiated work of singers and songwriters who, in their direct negotiations, have both the incentive and the flexibility to calibrate their comparative ownership, control and payoffs in light of their actual comparative contributions.

Again, the implication is that the relative value brought by singers and songwriters is complicated and variegated, which is emphatically not consistent with an assumption under which value is equal because, after a song is recorded, singers and their intermediaries own one necessary legal right whereas songwriters and their intermediaries own the other. The error, put simply, is an error of omission: the models presented to the CRB reflect what is, at best, the second half of the process by which music is licensed for streaming. The models start at a moment when music has already been recorded, and yet they assume that there are no then-existing contracts allocating money as between singers and songwriters, no then-existing constraints on the next round of negotiation, and indeed no then-existing relationships at all between singers and songwriters, or labels and publishers. The models instead implausibly assume that singers are completely free to arrogate to themselves whatever returns their intermediaries can collect, and songwriters are similarly completely free to arrogate to themselves whatever returns their intermediaries can collect.

Starting there, the models unsurprisingly conclude that record labels and music publishers should share equally in any profits. To them, singer Toni Braxton is just some nondescript owner of the veto right inherent in the sound recording copyright associated with each of her songs, and songwriter Diane Warren is just another completely interchangeable owner of the veto right inherent in the musical work rights associated with her songs. All variation—differences in relative talent, differences in next-best options,

differences in risk aversion, everything—and all ex ante negotiation is, without comment, abstracted away.[172]

And note that Shapley analysis does not suggest, justify, test, or endorse this conclusion. Equivalence was an input to, not an output from, the experts' analyses. The various Shapley models simply added a veneer of complexity to a flawed but enormously influential assumption: that, in a "fair" world, music publishers and record labels should earn the same profit.

V. Conclusion

Rate-making proceedings at the CRB are anything but welcoming. The evidentiary record in *Phono III*, *Phono IV* and *Web V* clocks in at well over 10,000 printed pages. The expert economists regularly speak in tongues. Even the Judges from time to time complain that years into a given proceeding they are unsure as to what certain stakeholders are arguing or what

[172] This problem threatens to undermine the entire set of compulsory licenses currently authorized by Congress. Because singers and songwriters can negotiate prior to creating recorded music, they are free to allocate monies between them according to whatever metrics they deem appropriate. Thus, while compulsory licenses to some degree determine how much money moves from streamers to copyright holders, the allocation from there is fully controlled by private deals. The CRB might order that certain monies be paid to the owner of the relevant musical work right, for instance, but the CRB has no power to stop that copyright owner from then either honoring or negotiating a contract under which some of those proceeds are transferred to the singer, record label, or some other party. Combine this with the reality that the CRB regulates some but not all of the licenses that streamers must acquire—*see supra* notes 31–35 and accompanying text—and a difficult question is framed as to the degree to which the CRB can plausibly accomplish any of its policy goals. After all, the CRB has limited power to determine the amount of money actually paid by streamers, because the total bill is determined by the combination of government-influenced rates and other rates that are privately negotiated in parallel, in response, and in their shadow. And the CRB at the same time has little power to determine the split of royalties as between singers and songwriters, because singers, songwriters, and their representatives directly negotiate. To actually control either flow, the government would need to offer a full set of compulsory licenses, thereby effectively capping the total amount that streamers pay, and the government would need to preempt private agreements between singers and songwriters, thereby ensuring that monies paid to (say) the sound recording copyright holders actually stay with those performers and their representatives. Short of that, the CRB has influence—contracts and workarounds are inevitably sticky, time-lagged, and the like—but the Judges, to at least some degree, are boxing with Jell-O. I wrote about these challenges in a forthcoming paper, Doug Lichtman, *The Seesaw Effect*, 47 Col. J. L. & Arts (forthcoming 2024).

assumptions are being made in support of competing rate proposals.[173] Combine that with a seventy-plus-year-old mathematical construct and there is a very powerful case to be made for ambivalence. The show is not worth the price of admission. The arcane details of Shapley analysis and the minutiae of CRB rate-making are best left to insiders alone.

But the rates at issue in these proceedings matter. The trends in the music industry are clear: CD sales have plummeted over the years, with consumers spending $13.2 billion on the format in the year 2000 but only $483 million twenty-two years later.[174] Direct sales of digital singles and albums do not come close to filling the gap, amounting to barely $456 million in 2022.[175] And, while the biggest stars might be able to earn substantial sums by touring or by licensing their music for use on television and in movies, those options are unavailable to the overwhelming majority of singers and songwriters who cannot fill stadiums and whose songs will never be picked for those types of use.

Billions of dollars, by contrast, are at stake every year in transactions governed by the CRB,[176] with Amazon, Apple, Spotify, Google, Pandora, and iHeart each either paying the CRB's rates or negotiating private licenses in their shadow. This is the money that will drive the music industry in the foreseeable future, and the money that will similarly drive the development of streaming and other technological advancements. And, while there is no easy formula for allocating those funds, my point is simply that Shapley analysis—the current darling of the ball—offers no helpful insight. Shapley models do not describe real-world markets. Shapley models offer no tools by which to measure market imperfections. The outputs of a Shapley model are incredibly sensitive to the relevant model's highly stylized inputs. And, worst of all,

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[173] *See, e.g., Phono III Remand*, *supra* note 16, at 54424 ("Regardless of whether economists invariably identify the existence of implicit assumptions lurking in each other's models, Professor Watt overlooked a cardinal rule of communication: Know your audience. Here, his audience is comprised of three Judges, only one of whom is also an economist."); *id.* at 54426 ("Similarly, when the Judges inquired of Copyright Owners' counsel whether he would be addressing the modeling 'dust-up' between Professors Watt and Katz, counsel demurred, stating that although he would 'love to engage on it but . . . there would be too many slides . . . .'").

[174] *See* U.S. Music Revenue Database at https://www.riaa.com/u-s-sales-database/ [https://perma.cc/K49J-JHYQ] (summarizing industry data from 1973 through 2022).

[175] *See id.* (showing revenue for album downloads in 2022 at $241.9 million, and single downloads at $214.1 million).

[176] *See id.* (showing streaming revenue combining to generate over $13 billion in 2022).

Shapley modeling is completely static, a troubling reality given that copyright law is by design a dynamic incentive system.

I recognize and appreciate that considerable time and thought has been invested here by stakeholders, experts, and the Judges themselves. And I am not writing to fault the process, which has been intense, and has remarkably brought together a veritable who's-who of expert economists and industry leaders. But this application of Shapley analysis is nevertheless a mistake, and it is time for the CRB to abandon the approach.