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PHOENIX CENTER POLICY BULLETIN NO. 41

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March 2017

SAFE HARBORS AND THE EVOLUTION OF MUSIC RETAILING

Abstract: According to the music recording industry, YouTube, one of the largest purveyors of on-demand digital music, evades paying market rates for the use of copyrighted content by exploiting the Digital Millennium Copyright Act's "safe harbor" provisions. The source of the distortion in licensing negotiation appears to be that at any one time, there may be multiple unauthorized copies of a particular song available notwithstanding compliance with the safe harbors, suggesting that services may essentially be able to offer access to music without paying royalties and still claim safe harbor protection for infringement. The evidence appears to confirm the claim: market-based royalties for subscription-based services are about eight-times larger than that paid by YouTube. An interesting question, it seems to us, is how much revenue the recording industry loses from the distortions caused by the safe harbor provisions? Employing accepted economic modeling techniques, we simulate revenue effects from royalty rate changes on YouTube's service. Using 2015 data, we find that that a plausible royalty rate increase could produce increased royalty revenues in the U.S. of $650 million to over one billion dollars a year. This is a sizeable effect, and lends credence to the recording industry's complaints about YouTube's use of the safe harbor.

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I. Introduction

In 1999, the year the Digital Millennium Copyright Act ("DMCA") was enacted, revenues for the recording industry in the United States reached nearly $21 billion (in current dollars), growing nearly 5% annually over the preceding decade.[1] The future looked bright. Fifteen years later, due in large part to digital piracy made possible by technology and high-speed Internet connections, sales were only $7 billion, a decline of 65% in real terms. The recording industry has responded to these challenges in a number of ways, first by licensing iTunes and, more recently, by successfully focusing on negotiating market-based licensing deals with on-demand subscription-based services such as Spotify, Apple Music, and Rhapsody, transforming music retailing from a physical to a cloud-based medium. Subscriptions surpassed 100 million globally in 2016 and continue to rise, and industry revenues have started to rise.[2] According to the Recording Industry Association of America ("RIAA"), the recording industry received $1.2 billion in revenues from subscription services in 2015, averaging nearly 11 million paid subscriptions for the year.[3] These numbers are expected to be significantly larger in 2016, though the official data is not yet released. While the industry is recovering, revenue remains well-below its earlier pinnacle.

The recording industry continues to face many challenges. One impediment to growth, the industry claims, is the availability of "free" music on internet platforms that rely on the "safe harbor" provisions of the U.S.'s Digital Millennium Copyright Act,[4] such as YouTube.[5] Music is vital to YouTube's platform and advertising revenues, accounting for 40% of its views.[6] Yet,

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[1] RIAA Shipments Database (2015).

[2] D. Moskowitz, *Streaming Music with the Most Paid Subscribers*, INVESTOPEDIA (September 12, 2016) (available at: http://www.investopedia.com/news/streaming-music-most-paid-subscribers-p).

[3] C. Sherman, *State of the Music Business, What the Numbers Tell Us,* MEDIUM (March 22, 2016) (available at: https://medium.com/@RIAA/state-of-the-music-business-what-the-numbers-tell-us-63ce1524b30#.k8ac7i69h).

[4] 17 U.S.C. § 512.

[5] G. McMillan, *Study: More People Watch Music On YouTube Than Download It*, TIME (April 12, 2011) (available at: http://techland.time.com/2011/04/12/study-more-people-watch-music-on-youtube-than-download-it);

[6] E. Lee, *What's the Most Popular Channel on YouTube?*, ADVERTISING AGE (August 16, 2011) (available at: http://adage.com/article/digital/popular-channel-youtube/229281); T. Ingham, *YouTube Earnt $9bn in Revenue Last Year, Towering Over Spotify*, MUSIC BUSINESS WORLDWIDE (January 5, 2016) (available at: http://www.musicbusinessworldwide.com/youtube-will-earn-9bn-in-revenue-this-year-towering-over-spotify); M. Mulligan, STATE OF THE YOUTUBE MUSIC ECONOMY, MIDiA (June 2016) (available at: https://www.midiaresearch.com/blog/the-state-of-the-youtube-music-economy). *See also* Comscore rankings for online video for June, 2015 (available at http://www.comscore.com/Insights/Rankings/comScore-Releases-June-2015-US-Desktop-Online-Video-Rankings). Per these rankings, the Vevo channel on YouTube alone accounted for 25%

YouTube pays the recording industry well-below market rates for this heavy and on-demand use of music by relying on those "safe harbor" provisions.[7] IPFI, a non-profit international organization representing the global recording industry, observes that the 68 million global subscriptions to music service—where royalties are based on market negotiations—generate $2 billion in revenues for artists and labels.[8] But, as a result of a "critical distortion in the market" permitted by DMCA safe harbors and similar safe harbors in other jurisdictions, the 900 million users of ad-based services generate only $634 million in revenues.[9] Industry data indicates that playing a song a subscription music service pays the recording industry about $0.008 per play, while the same play on YouTube offers compensation of only about $0.001. It's plainly a huge price difference for close substitutes.

An important question, it seems to us, is how much is the recording industry losing in revenues because of the safe harbor? It is a difficult question to answer, but nonetheless an important public policy issue. Quantifying the size of this market distortion is not as simple as multiplying the average subscription revenue by the millions of users of YouTube's services. For one thing, not everyone is willing to pay for a subscription, and the average consumption may differ across platforms. Still, the availability of the same play for "free" on YouTube likely deters subscribers from paying for it, and the relatively low royalty paid by YouTube is certain to have a significant effect on the recording industry's revenues. In this BULLETIN, we employ a simple and conventional economic model in an attempt to quantify U.S. revenues lost to artists and labels by YouTube's reliance on the DMCA's safe harbor provisions. Employing accepted economic modeling techniques, we are able to simulate revenue effects from royalty rate changes, thereby demonstrating how such a procedure can work and what data is required for the task. The revenue effects of the safe harbor vary, of course, by the assumed royalty change and other assumptions in our model, but the analysis suggests that YouTube's reliance on the DMCA's safe harbor provisions reduce revenues to artists and labels in the U.S. by at least hundreds of millions and by perhaps more than one billion dollars each year.

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of the unique visitors to all Google online video properties. We note that there is more music watched or listened to on YouTube than just what is available via Vevo channel on YouTube.

[7] P. Resnikoff, *9 Reasons Why You Won't Pay $9.99 for "Apple Music"*, DIGITAL MUSIC NEWS (June 3, 2015) (available at: http://www.digitalmusicnews.com/2015/06/03/9-reasons-why-you-wont-pay-9-99-for-apple-music) ("1. Free music on YouTube. YouTube has every song ever made, and is the single largest source of music consumption in the world (by a huge margin). Not only that, it has a larger collection than Spotify, iTunes, or the 'Apple Music' streaming service will ever have.").

[8] IFPI, GLOBAL MUSIC REPORT (2016) at p. 5 (available at: http://www.ifpi.org/downloads/GMR2016.pdf).

[9] *Id*.

II. Simulating the Revenue Effects of a Royalty Change

Digital streaming services, not subject to safe harbors and typically paying market rates for music licenses, paid on average $18 per global user in 2014.[10] YouTube, in contrast, delivered less than $1 per global user. On a per play basis, market royalties for on-demand services average about $0.0079, whereas YouTube pays only about $0.001, an eight-fold difference. According to the recording industry, a key factor determining this royalty differential is the DMCA's safe harbor provision, which allegedly distorts licensing negotiations. For instance, the IFPI states that services protected by the safe harbors "claim they do not need to negotiate licenses for the music available on their platforms, or conclude licenses at artificially low rates."[11] The source of the distortion in licensing negotiation appears to be that at any one time, there may be multiple unauthorized copies of a particular song available notwithstanding compliance with the safe harbors, suggesting that services may essentially be able to offer access to music without paying royalties and still claim safe harbor protection for infringement. For this reason, the recording industry often points out that "notice and takedown" is not "notice and stay down."[12] Instead, the harsh reality is that "notice and takedown" has become an expensive and litigious game of "whack a mole."[13]

The practical implications of the "whack-a-mole" character of regulation on negotiations between the recording industry and YouTube are expressed colloquially by RIAA Chairman and CEO Cary Sherman:

> The way the negotiation goes is something like this: "Look. This is all we can afford to pay you," YouTube says. "We hope that you'll find that reasonable. But

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[10] IFPI, *supra* n. 8 at p. 23.

[11] *Id.*

[12] D. Hartline, *Notice-and-Staydown and Google Search: The Whack-A-Mole Problem Continues Unabated*, Center for the Protection of Intellectual Property (January 17, 2016) (available at: https://cpip.gmu.edu/2016/01/17/notice-and-staydown-and-google-search-the-whack-a-mole-problem-continues-unabated).

[13] *See, e.g.*, I. Azoff, *Dear YouTube: An Open Letter from Irving Azoff*, RECODE (May 9, 2016) (available at: http://www.recode.net/2016/5/9/11609494/irving-azoff-youtube-artists-streaming-music). For example, in 2008 Time Warner Music decided to pull its content from YouTube because of a failure to reach a fair market deal for music licensing. *See* P. Kafka, *Warner Music Group Disappearing From YouTube: Both Sides Take Credit*, ALL THINGS D (December 20, 2008) (available at http://allthingsd.com/20081220/warner-music-group-disappearing-from-youtube-both-sides-take-credit). One year later, after spending a fortune trying to take down their music, trying to keep up with all the counter-notifications that were constantly being filed, and earning no revenues at all, Time Warner Music finally threw in the towel and accepted YouTube's low-ball offer. P. Kafka, *Here's Why the Music Labels Are Furious at YouTube. Again.* RECODE (April 11, 2016) (available at: http://www.recode.net/2016/4/11/11586030/youtube-google-dmca-riaa-cary-sherman).

> that's the best we can do. And if you don't want to give us a license, okay. You know that your music is still going to be up on the service anyway. So send us notices, and we'll take 'em down as fast we can, and we know they'll keep coming back up. We'll do what we can. It's your decision as to whether you want to take our deal, or whether you just want to keep sending us takedown notices." That's not a real negotiation. That's like saying, "That's a real nice song you got there. Be a shame if anything happened to it."[14]

Warner Music Group CEO, Stephen Cooper, corroborates. According to Mr. Cooper,

> The problem is that services like YouTube are on-demand, just like the paid ones. The key distinction is that unlike subscription services, these guys are taking advantage of "safe harbors" to negotiate licenses. It's a fundamental market distortion that skews competition. Multi-billion-dollar businesses have been built on the back of music. They are taking music for granted and treating it like a commodity. *** [However, m]usic isn't a commodity. It's not something that fills pipes. Songs by Led Zeppelin or Andra Day are unique works of art. Irreplaceable moments in culture, where only the real thing will do.[15]

These descriptions of the negotiating process reveal the concern by the recording industry that the safe harbors, designed to shield Internet intermediaries from contributory liability for infringements, are being exploited in a manner unintended by the implementing statutes.

In 2015, several analysts estimated that YouTube paid $741 million globally to rightsholders for the consumption of their music, a number that appears well below market compensation from one of the world's largest music delivery platforms.[16] Most of this royalty revenue is comes from a split of YouTube's advertising revenue with artists and labels rather than the fixed per-play royalty typically seen for streaming services (both subscription and ad-based). A percentage of advertising revenue—especially if either the percentage is low or the ad revenues are low—may be inadequate compensation for the use of music. Just because an advertising platform cannot generate large advertising revenues does not imply it should pay very little for the heavy use of

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[14] P. Kafka, *Here's Why the Music Labels Are Furious at YouTube. Again.* RECODE (April 11, 2016) (available at: http://www.recode.net/2016/4/11/11586030/youtube-google-dmca-riaa-cary-sherman).

[15] A. Flanagan, *"Music Isn't a Commodity": Warner Music CEO Stephen Cooper on That Streaming Milestone, the "Value Grab"*, BILLBOARD (May 13, 2016) (available at: http://www.billboard.com/articles/business/7370348/warner-music-ceo-stephen-cooper-digital-global-strategy).

[16] M. Mulligan, *State of the YouTube Music Economy*, MIDiA (July 2016) (available at: https://www.midiaresearch.com/blog/the-state-of-the-youtube-music-economy); T. Ingham, *Youtube Earnt $9bn in Revenue Last Year, Towering Over Spotify*, MUSIC BUSINESS WORLDWIDE (January 5, 2016) (available at: http://www.musicbusinessworldwide.com/youtube-will-earn-9bn-in-revenue-this-year-towering-over-spotify).

music. Indeed, the worse the business plan, the less is paid for music under such a scheme. Recognizing the potential for such perverse outcomes, market negotiations for the rights to sound recordings typically include some type of per-play royalty (in addition to revenue sharing) to avoid under-compensation from business plans that generate too little revenue.

While it appears that YouTube is under-compensating the recording industry, the question we seek to answer is by how much it does so? The effect of the distortions caused by the safe harbor on the recording industry's U.S. revenue may be approximated by simulating the revenue consequences of applying a realistic royalty on YouTube's plays. It is not our intent to determine what royalty YouTube should or would pay for its use of music, so we consider a range of plausible royalty figures. The most sensible royalty, it seems to us, is the per-play royalty paid by the on-demand subscription platforms (which is eight-times larger than that paid by YouTube), since these services are most like YouTube in terms of the service delivered to consumers. Quantifying the royalty revenue effect on the recording industry turns out to be a complex problem, but we will attempt to shed some light on the issue here. Given data limitations, our analysis must be very preliminary, but we hope to initiate a discussion of this important issue on a strong economic foundation.

III. An Economic Analysis of Revenue and Royalty Rates

Music is an essential input for a music distribution platform. Without music, there would be no Spotify, no Pandora, no Sirius XM, and many fewer terrestrial radio stations. Music is indispensable, so the price a platform pays for music has consequences, potentially affecting the price and income of the platform and influencing consumer demand for and among music platforms. The consequences of royalty policy for the consumption of music and the incomes of suppliers and rights holders depends, *inter alia*, on the structure of consumers' demands for music and the effects of changes in royalty rates on the (full) prices paid for music on the various platforms.[17] Thus, in evaluating the effect of royalty levels, and changes in those levels, at a minimum one must consider, and make reasonable allowance for, substitution in consumption by consumers and the "pass-through" of any change in royalties on consumer prices. Our goal is to construct an algorithm to evaluate royalty changes on the income that is shared by artists and labels, but doing so presents a number of difficult problems.

First, there is little formal economic literature available that provides useful estimates on important market demand statistics, such as own-price or cross-price elasticities of demand for and among the various music platforms. This dearth of evidence is unsurprising given the fluidity of this industry, and the firm-specific (or even proprietary) nature of this sort of business intelligence. It is therefore inevitable that calculations will have to rely on piece-meal estimates,

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[17] In the long-run, the effects of royalty policy on entry and supply must also be contemplated.

rather than any recent, systematic econometric estimation of the demand for music, in its many guises, in the United States.

Second, the nature of the retail music business is extremely fragmented: consumers are able to access music through terrestrial radio, satellite radio, online streaming services of both interactive and non-interactive types, YouTube, digital downloads, permanent copies like CDs and vinyl, and so on. These many platforms vary widely in costs, quality, and immediate availability, but in the global sense they are almost certainly weak gross substitutes. However, these different platforms are idiosyncratically differentiated, and some allowance for this is logically necessary. Here, we consider only the online streaming services as close substitutes, setting aside the terrestrial radio, satellite radio, and personal copy platforms including physical media and digital downloads. We do not mean to imply that no user might find these platforms substitutable for YouTube, but we believe the streaming services are YouTube's closest competitors because the consumer's experience is very similar identical across the platforms.

Third, the price mechanisms used to drive the various platforms' business models vary widely. There are at least two major issues to address. Some services, such as Youtube and non-interactive streaming (such as some Pandora products) are funded by advertising and thus "free" to the consumer, in the sense that there is no *direct* financial transaction between listener and broadcaster/music service. Additionally, even when there is a conventional "buyer-pays-seller" contract at work (e.g., Spotify), the nature of the contract often involves monthly subscriptions and rarely involves a price per song played. These complications have important consequences for the specification of a feasible demand model of the retail music business for which an average retail price must practically be specified.

Consider the role of advertising-supported models for the analysis of consumer music demand. On the one hand, services such as ad-based streaming services do not receive income directly from consumers, so in one sense such services are "free." Some of these services are not interactive (e.g., Pandora), but some are (e.g., YouTube). Both common sense and available evidence establishes that this advertising affects listenership. Consumers will sometimes pay to avoid advertisements, as no-advertising versions of several popular ad-based streaming services illustrate (e.g., Pandora One). It is the unobserved "full prices" paid by consumers that determine their consumption of these and competing music services. Some means of accounting for this "full price" is required.

Fourth, the issue of non-linear pricing, as when a music service allows a listener full access 24/7 in exchange for a fixed monthly fee, is quite familiar to analysts of public utility services.[18] There is no wholly satisfactory solution for measuring "the price" of such a service, particularly when multiple types of contracts, special introductory offers, and so on, are used simultaneously. The simplest approach, often used, for example, in competitive analyses of telecommunications services, is an "average revenue per unit" ("ARPU") calculation to obtain a "price" for the service in question.[19] This simplification is much less injurious in hypothetical "long-run" calculations since, in such cases, the nonlinear nature of the recurring contract occurs at a high-enough frequency so that the assumption that the buyer adjusts to minimize her average cost per unit consumed is plausible.

Fifth, evaluation is further complicated by the fact that consumers do not pay royalties directly. Instead, royalties affect the full prices faced by consumers for different platforms through the royalty's implicit effect on price. As is well known, even in the simplest cases, the relationship between input price and output price depends on input substitution, market structure/competition, and so on.[20] In attempting to simulate the possible consequence of a royalty change affecting one service on the consumption levels and royalties of *all* services, one must specify a "pass-through" coefficient. This coefficient will determine the effect of a given royalty change on the price of the subject platform service. One is then left with the complex question of how such a price change could affect the prices of other platform services, a difficulty we set aside in this analysis.

A. *Specifying a Model*

The discussion above makes clear that estimating the effects of a change in royalty rates on music consumption across platforms and, by implication, on the income of the recording industry, is a very complicated problem. Nevertheless, it is a worthwhile exercise for several reasons. First, even a relatively low-dimensional economic demand model is likely to significantly outperform pure accounting exercises that ignore demand responses and substitution entirely. This advantage is potentially significant because the royalty rates for the

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[18] *See, e.g.*, B.M. Mitchell and I. Vogelsang, TELECOMMUNICATIONS PRICING: THEORY AND PRACTICE (1991), at Ch. 5; C.G. Krouse, THEORY OF INDUSTRIAL ECONOMICS (1990), at Ch. 7.

[19] L.D. Taylor, TELECOMMUNICATIONS DEMAND IN THEORY AND PRACTICE (1994); T.R Beard, G.S. Ford, R.C. Hill, and R. Saba, *The Flow Through of Cost Changes in Competitive Telecommunications: Theory and Evidence*, 30 EMPIRICAL ECONOMICS 555-573 (2005); T.R. Beard and G.S. Ford, *Competition In Local Exchange and Long Distance Telecommunications Markets*, in INTERNATIONAL HANDBOOK ON TELECOMMUNICATIONS ECONOMICS, Vol. I, Ch. 4 (G. Madden, ed.) (2003).

[20] Beard, Ford, Hill and Saba, *id*; J. Bulow and P. Pfleiderer, *A Note on the Effect of Cost Changes on Prices*, 91 JOURNAL OF POLITICAL ECONOMY 182–85 (1983).

recording industry applied to different music platforms vary enormously: for example, in 2015 (as detailed below), non-interactive ad-supported streaming services paid an average of $0.0017 per play, on-demand subscription services paid $0.0079 per play, and YouTube paaid $0.001 per play. Rightsholders would welcome some sorts of customer migration to better paying platforms, but would be harmed by other sorts that reduce revenues.[21] Additionally, the application of a theoretically coherent demand model allows the analyst to evaluate the consequences of changes in various assumptions far better than any ad hoc approach.

Given these considerations, our approach is thoroughly conventional: we will specify a "representative consumer" demand model, restricted to an inelastic (i.e., constant) level of overall spending on music, and calibrate the model using several plausible sets of market statistics. In particular, we will use plausible own-price elasticities, combined with observed data on market activity, to determine the underlying set of "deep" parameters, or the demand characteristics, that determine the representative consumer's responses to any changes in prices. The model we select for this purpose, the so-called generalized Constant Elasticity of Substitution ("CES") utility function, offers several important advantages. In particular, this model allows for platform-specific parameters, so idiosyncratic differences are accommodated, but the procedure remains tractable. The model is further consistent with the assumption that all platforms are substitutes to some extent or another, though limited data on specific cross-price relationships imposes severe limitations on our treatment of substitution.

Prices for any services sold under any sort of tariff are calculated in the usual "average revenue per unit" way: consumer spending on the relevant service is divided by units of output (e.g., "plays" using the term of art) to obtain a per unit "price." In the case of services that are "free", i.e., advertising-based models of music delivery, we assume that the full price paid by consumers is just the amount of advertising associated with an average unit of consumption (i.e., a "play"). This quantity of advertising is taken to be equal to the observed advertising spending per unit consumed. Royalties are treated similarly, dividing the income received by the recording industry from the music platform divided by plays.

Finally, with respect to the "pass-through" coefficients for royalty changes, we will begin our work with the simple proportional formulation: an increase in the per-play royalty of x raises the price per-play by some fraction of x. In general, economic theory suggests that firms treat prices as "strategic complements," meaning that a rival's price increase is ordinarily met by a price increase of one's own service.[22] This effect becomes progressively less-pronounced as market competition increases: in perfect competition, price is driven to cost. Alternative formulations

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[21] Market-based rates may vary by platform, but the substitution effects are presumably accounted for in such differences.

[22] J. Bulow, J. Geanakoplos, and P. Klemperer, *Multimarket Oligopoly: Strategic Substitutes and Strategic Complements*, 93 JOURNAL OF POLITICAL ECONOMY 488-511 (1985).

and simulations are feasible, however, and we could evaluate their effects by specifying alternative price reactions.

We model the recorded music market with a CES framework as it provides a rich, yet tractable, way to model the demand for a set of related goods. To begin, therefore, the representative consumer is assumed to have the following CES utility function:

$$U = \left(\sum_{i=1}^{n} \beta_i q_i^{-\frac{1-\sigma}{\sigma}} \right)^{-\frac{\sigma}{1-\sigma}}, \tag{1}$$

where $\beta_i > 0$ and $\beta_1 = 1$ (a non-informative normalization). Note that there are n platforms, q_i represents quantity consumed of the i^{th} platform, and σ is a parameter measuring demand elasticity. Given prices (p_i) and fixed total expenditure on music products (m), the consumer's budget constraint can be written as follows:

$$p_1 q_1 + p_2 q_2 + \ldots + p_n q_n = m\,. \tag{2}$$

Consumer demand is determined by the maximization of the utility function subject to the budget constraint. Formally, the Lagrangian function that would be maximized is given as:

$$L = \left(\sum_{i=1}^{n} \beta_i q_i^{-\frac{1-\sigma}{\sigma}} \right)^{-\frac{\sigma}{1-\sigma}} + \lambda\left(m - p_1 q_1 - p_2 q_2 - \ldots - p_n q_n\right). \tag{3}$$

The first-order conditions for optimizing the Lagrangian function for a set of (n + 1) non-linear equations is:

$$\beta_i q_i^{-\frac{1}{\sigma}} \left(\sum_{i=1}^{n} \beta_i q_i^{-\frac{1-\sigma}{\sigma}} \right)^{-\frac{\sigma}{1-\sigma}} = \lambda p_i, \quad \text{for } i = 1 \ldots n\,; \tag{4a}$$

$$\left(m - p_1 q_1 - p_2 q_2 - \ldots - p_n q_n\right) = 0\,. \tag{4b}$$

Although the algebra is difficult, these non-linear equations may be solved for the demand curves:

$$q_i^* = \frac{m}{p_i} \frac{\beta_i^{\sigma} p_i^{1-\sigma}}{\sum_{j=1}^{n} \left(\beta_j^{\sigma} p_j^{1-\sigma}\right)}\,. \tag{5}$$

Notice in Expression (5) that the demand for each good depends (i) on the prices of all goods (each j of n). Hence, a single royalty change affecting one price will potentially impact the demand for all of the goods, even when other platform prices do not change, and the royalty revenue derived from all of the goods will be affected.

The own- and cross-price elasticities can be calculated from these demand curves. For example, the own-price elasticity of the i^{th} good is given as:

$$\frac{\partial q_i}{\partial p_i}\frac{p_i}{q_i} = \varepsilon_{ii} = -1 + (1-\sigma)\left(1 - \frac{p_i q_i^*}{m}\right). \tag{6}$$

Using this framework, we use available market data as inputs to this demand system to computationally solve for the deep parameters of the model (β_2, β_2, …, β_n, σ). Once we calibrate these parameters to the available data, the impact of changes to a royalty rate (or rates) can be simulated. For simplicity, we will assume that there is linear pass-through of royalty changes so that $\Delta p_i = \theta \Delta r_i$, where r_i is the per-unit royalty rate on the i^{th} service and θ is a pass-through parameter (e.g., $\theta = 1$ for full pass-through, and $\theta < 1$ for the more realistic case of partial adjustment). We may vary Δr_i and θ to test the sensitivity of total revenues to various situations.

B. *Pass-Through of Royalty Changes*

Theoretically, the rate of pass-through to prices of a cost change depends on a number of sometimes-related factors, including market structure, the curvature of the demand curve, the elasticity of demand, and so forth. For linear demand the pass-through for a single-product monopolist is one-half of a change in marginal cost. Other demand specifications lead to different pass-through rates, both below and above 100% pass-through. Empirical evidence on pass-through varies, and the evidence shows that an individual firm passes through cost changes to a lesser extent than does an industry, and that pass-through is less in the short-run than in the long-run.[23]

When firms sell multiple inter-related products and services, the analysis of pass-through will be very complicated. This issue of inter-related services is particularly relevant here, since analysts believe that YouTube is less a "standalone business" than a tool for Google to gather customer viewing and buying habits, which it then sells.[24] If this is correct, then pass-through

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23 RBB Economics, *Cost Pass-Through: Theory, Measurement, and Potential Policy Implications*, REPORT PREPARED FOR THE OFFICE OF FAIR TRADING (February 2014) (available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/320912/Cost_Pass-Through_Report.pdf).

24 E. Sherman, *4 Reasons YouTube Still Doesn't Make a Profit*, CBS News (May 27, 2015) (available at: http://www.cbsnews.com/news/4-reasons-youtube-still-doesnt-make-a-profit); R. Winkler, *YouTube: 1 Billion Viewers, No Profit*, Wall Street Journal (February 25, 2015) (available at: https://www.wsj.com/articles/viewers-dont-

likely will be less than a simple model would suggest. This can easily be illustrated in the simplest case.

Suppose that a firm sets a price p which results in a quantity sold of q, so $p = p(q)$ and $\partial p/\partial q < 0$. Let c be the (constant) per-unit cost of service q. However, suppose the operation of this market results in outside income to the seller, perhaps from the collection of valuable information on the buyers, as is widely-believed in the case of YouTube. This consumer information is packaged and sold to third parties. Suppose that the income from this information sale is equal to some proportion of the revenue of the relevant market (pq). In this case, one sees immediately that the pass-through effect $\partial p^*/\partial c$ is closely related to the proportion between the revenue of the market (pq) and the seller's outside income. Let us designate this proportion as "e" (for "ecommerce"). Then the firm's relevant profit is:

$$(1 + e)pq - cq. \tag{7}$$

The optimality condition for profit maximization is:

$$p + \left(\frac{\partial p}{\partial q}\right)q = \frac{c}{1+e}. \tag{8}$$

Hence, this problem is mathematically equivalent to the problem of maximizing pq - $\hat{c}q$, where $\hat{c} = c/(1+e)$. Thus the pass-through relation is

$$\frac{\partial p^*}{\partial c} = \frac{\partial p^*}{\partial \hat{c}}\left(\frac{1}{1+e}\right). \tag{9}$$

In other words, the pass-through rate is reduced by the factor $1/(1 + e)$ compared to the case where there is no outside income ($e = 0$). If e is large, then pass-through becomes very small.

This analysis suggests that YouTube's pass-through rate of a royalty increase may be quite low. Still, we have little theoretical basis for setting a particular pass-through rate. Consequently, we must turn to empirical evidence on firm pass-through rates. A study by Hellerstein and Villas-Boas (2010) employs a structural econometric model to evaluate pass-through of cost changes by firms that outsource input production.[25] The study finds that the elasticity of price to cost changes

add-up-to-profit-for-youtube-1424897967); L. Rao, *YouTube CEO Says There's 'No Timetable' For Profitability*, Fortune (October 18, 2016) (available at: http://fortune.com/2016/10/18/youtube-profits-ceo-susan-wojcicki).

25 R. Hellerstein and S. Villas-Boas, *Outsourcing and Pass-Through*, 81 JOURNAL OF INTERNATIONAL ECONOMICS 170–183 (2010).

average around 0.13, meaning a 10% increase in cost leads to a 1.3% increase in price. Similarly, an empirical study by Ashenfelter, *et al.* (1998) finds a pass-through elasticity of 0.15.[26] Gron and Swenson (2000) and Peltzman (2000) find similar pass-through elasticities a the level of the firm.[27] Given Google's use of YouTube as a platform that supports its primary advertising revenue stream, we expect the pass-through for YouTube may below. Since we do not know, ex ante, exactly what the pass-through rate will be, we consider a few pass-through elasticities, setting θ to produce pass-through elasticities of 0, 0.10, and 0.20. Further, to make our analysis conservative, we will completely ignore the probable increases in the "prices" of other platforms that arise from an increase in YouTube's "price."

C. *Data*

We formulated the conceptual framework outlined above with an eye toward the availability of data (or lack thereof). While statistics on the recording industry are routinely collected and offer insightful descriptions of the industry, for our purposes the industry is not a data-rich environment. Econometric evidence, especially recent evidence, is sparse. There is almost no information on own- and cross-price elasticities, for instance, in large part due to the proprietary nature of the data and the dynamic nature of the industry. Platforms come and go. The rise of the cassette tape coincided with the decline of vinyl; the rise of the compact disc ("CD") saw the decline of the cassette tape; digitization of music into downloads replaced the CD, and now streaming services are displacing all types of permanent copies.[28] Since the early 1990s, digitization, the deployment and adoption of high-speed Internet networks, and inadequate enforcement of rights, permitted piracy to devastate the recording industry's revenues. The recording industry does not sit still for long, complicating the econometric analysis of the relationships between quantities and prices of and among the various and frequently changing platforms.

As our analysis is preliminary, we limit our attention in a number of ways. First, we consider especially online "cloud-based" services including YouTube, subscription streaming, and statutory (non-interactive) streaming. These platforms are all consumed using some type of device connected to the Internet. We limit our attention to the U.S. market and to the royalty

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[26] O. Ashenfelter, D. Ashmore, J.B. Baker & S-M. McKernan, *Identifying the Firm-Specific Cost Pass-Through Rate*, Federal Trade Commission, Bureau of Economics Working Paper No. 127 (January 1998) (available at: https://www.ftc.gov/reports/identifying-firm-specific-cost-pass-through-rate).

[27] A. Gron and D. Swenson, *Cost Pass-Through in the U.S Automobile Market*, 82 REVIEW OF ECONOMICS AND STATISTICS 316-324 (2000); S. Peltzman, *Prices Rise Faster than They Fall*, 108 JOURNAL OF POLITICAL ECONOMY 466-502 (2000).

[28] RIAA, *supra* n. 1.

revenues of artists and record labels, ignoring all ancillary revenues artists might earn from complementary sources. Much of the data available to us is provided by RIAA reports and data releases, but supplemented, when necessary, by other public sources.[29]

For on-demand subscription streaming services, RIAA reports retail revenues of $1.2 billion, from which we estimate royalties of $670 million. This platform delivered about 85.3 billion plays, so the average retail price is $0.014 per play and the implied average royalty is $0.0079 per play.[30] Based on RIAA revenue reports, we estimate there were $588.5 million in statutory services royalties in 2015, but RIAA does not report retail revenues. We use Pandora, the largest of the statutory streaming services, to approximate retail revenues. We estimate that Pandora delivers about 240 billion plays for which it received revenues of $1.15 billion in 2015. Thus, the average retail "price" is $0.0047 per play in 2015. The volume for the entire statutory streaming platform is estimated at 340.5 million plays, so the platform revenues are estimated to be about $1.6 billion.[31] Based on this play count, the effective royalty is $0.0017 per play, which is consistent with a blend of statutory rates in 2015 (the range is $0.0014 per play to $0.0025 per play, depending on the nature of the statutory service).

According to what public information is available, YouTube listeners across the globe consumed 750 billion songs using the service in 2015, with associated royalty payments of $741 million, which is the equivalent of $0.001 per spin.[32] Of this total, the U.S. recording industry received $227 million, or about 30.6%, suggesting about 230 billion plays in the U.S. at the average royalty. Estimates indicate that 40% of viewers clicked on YouTube to watch music videos.[33] Vevo, a joint venture among record labels, is YouTube's most watched channel and accounts for

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[29] We are grateful to Josh Friedlander at RIAA for his gracious help with the organization's data.

[30] D. Johnson, *See How Much Every Top Artist Makes on Spotify*, TIME (November 18, 2014) (available at: http://time.com/3590670/spotify-calculator); T. Nath, *How Pandora and Spotify Pay Artists*, INVESTOPEDIA (October 28, 2015) (available at: http://www.investopedia.com/articles/personal-finance/121614/how-pandora-and-spotify-pay-artists.asp); P. Kafka, *Here's What Happens to Your $10 After You Pay for a Month of Apple Music*, RECODE (June 15, 2015) (available at: http://www.recode.net/2015/6/15/11563558/heres-what-happens-to-your-10-after-you-pay-for-a-month-of-apple-music); V. Luckerson, *Here's How Much Money Top Musicians Are Making on Spotify*, TIME (December 3, 2013) (available at: http://business.time.com/2013/12/03/heres-how-much-money-top-musicians-are-making-on-spotify).

[31] Pandora Form 10K (2016).

[32] Mulligan, *supra* n. 6.

[33] E. Lee, *What's the Most Popular Channel on YouTube?*, ADVERTISING AGE (August 16, 2011) (available at: http://adage.com/article/digital/popular-channel-youtube/229281/); T. Ingham, *YouTube Earnt $9bn in Revenue Last Year, Towering Over Spotify*, MUSIC BUSINESS WORLDWIDE (January 5, 2016) (available at: http://www.musicbusinessworldwide.com/youtube-will-earn-9bn-in-revenue-this-year-towering-over-spotify); Mulligan, *supra* n. 6.

nearly 40% of YouTube's monthly viewers in 2011.[34] Assigning 40% to YouTube's $9 billion in total revenues to music and 30.6% of this amount to the U.S. market produces an effective retail price for music on YouTube of $0.0048 per play.[35] This effective retail price is nearly identical to that of the statutory streaming services. Table 1 summarizes the inputs to our model.

Table 1. Music Platforms Included in Simulation (2015 data)

	Retail Sales (billions)	Recording Industry Royalties (millions)	Plays (billions)	Retail Price (per play)	Royalty (per play)
Paid Streaming	$1.22	$670	85.3	$0.0140	$0.0079
Ad-Supported Streaming	$1.62	$589	340.5	$0.0047	$0.0017
YouTube	$1.10	$227	230	$0.0048	$0.0010

In order to calibrate our model, we require at least one own-price elasticity for a platform. Own- and cross-price elasticities for the services are then calculated based on relative consumption shares. For reasons discussed above, there is almost no current information on the own-price elasticity estimates for music consumption. In our model, an own-price elasticity of -1 for a service implies that all the platforms are independent (an interesting, if unrealistic, assumption), whereas an elastic demand ($\varepsilon < -1$) implies substitution, and an inelastic demand ($-1 < \varepsilon < 0$) implies complementarity between platforms. Given the lack of other information on own-price elasticities, we assign the own-price demand elasticity to on-demand subscriptions services and assume it is equal to or less than -1 (and conduct simulations at various levels close to -1).

Given these inputs, we calibrate the model. Then, by changing the license fee or royalty of any one service, service price will reflect the pass-through of the royalty change, and this will lead to changes in the consumptions of all platform services in the model. In the representative consumer model, the higher price for one platform leads to substitution from the platform with a higher simulated price to other platforms in proportion to consumption levels (for any $\varepsilon < -1$). Based on this adjustment in consumption patterns, the model estimates the change in revenues to artists and labels based on the average royalties per play.

D. *Simulating Revenue Effects*

Using the inputs outlined above, we calibrate the model and then assume various royalty increases for YouTube's use of music to simulate the revenue impacts on the recording industry. There are three primary inputs to consider: (1) the simulated royalty rate change (Δr); (2) the rate

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34 Lee, *id.*; *see also* Comscore 2015, *supra* n. 6.

35 Mulligan, *supra* n. 6.

of pass-through of the royalty change (θ); and (3) a single own-price elasticity of demand, which we apply to on-demand subscription services (ε_S).

All our simulations alter the royalty rate paid by YouTube. Again, our intent is not to propose or justify any particular change in this royalty rate, so we consider three alternatives for illustrative purposes. YouTube, for all practical purposes, offers an on-demand music service akin to that offered by subscription on-demand audio streaming services (though YouTube's service often, but not always, includes a relevant video component).[36] Naturally, a sensible royalty would at least match the effective rate for the on-demand subscription services those services most closely match YouTube's offering, which we estimate to be about \$0.0079 per play. At the low end, we consider the average per-play rate paid by ad-based audio streaming platforms in 2015 of \$0.0017. Given the on-demand nature of YouTube, this rate is likely to be below the free market level, but it serves as a lower bound. The mid-point of these rates is a rate of \$0.0048 per play. Our simulation computes the revenue impact of applying these three hypothetical royalty rates to YouTube plays (currently estimated at \$0.001 per play).

For pass-through, we consider, based on the econometric evidence of pass through, three pass-through elasticities: 0.0, 0.10, and 0.20. The θ parameter is not an elasticity, so we set θ to produce the target elasticity. The elasticity depends on the size of the price change, so we calibrate θ to produce the target elasticity for the largest royalty increase (to \$0.0079), resulting in θ values of 0.0, 0.12 and 0.25.

Importantly, all our simulated revenue effects are based on 2015 data, which, while recent, is now a somewhat inaccurate characterization of the recording industry. The revenue estimates we provide below are best characterized as hypothetical total royalty impacts for the recording industry of a royalty change as if it were applied in 2015. As more complete data becomes available for 2016 (and onwards), we hope to update our analysis.

E. *Independence with Pass-Through*

We begin with the simplest case, assuming the independence of the services (ε_S = -1). Under the assumption of independence, a royalty change for YouTube *does not impact* revenues from other platforms, but the quantity consumed of music on YouTube is possibly affected (if there is any positive pass-through). The results across the royalty changes and pass-through assumptions are summarized in Table 2.

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[36] Given that YouTube is an audio-visual on demand streaming service, it is possible that a market based royalty rate for YouTube would be higher than that for an audio only on demand streaming service.

Table 2. Royalty Changes with Independent Platforms

θ	Pass-through Elasticity	Royalty (per play)	Royalty Revenue Change (mil.)
0.00	0.00	\$0.0017	\$163
0.00	0.00	\$0.0048	\$872
0.00	0.00	\$0.0079	\$1,578
0.12	0.03	\$0.0017	\$157
0.12	0.07	\$0.0048	\$778
0.12	0.10	\$0.0079	\$1,313
0.25	0.07	\$0.0017	\$149
0.25	0.14	\$0.0048	\$690
0.25	0.20	\$0.0079	\$1,102

Table 2 indicates that the potential revenue effects of a royalty change with no pass through may be quite large. Even at the modest increase to \$0.0017, the recording industry would have received an additional \$163 million in revenue in 2015. Increasing the rate to \$0.0079, raising the royalty to a level commensurate with subscription streaming (at 2015 rates), the recording industry would have received an additional \$1.6 billion in revenues in that year. "Splitting the difference" at a rate of \$0.0048, industry revenues would have been higher by \$872 million in that year. Note that under these assumptions, the effect on revenue is linear in the royalty change, so it easy to interpolate the intermediary values.

Permitting some pass-through of the royalty increase demonstrates the effects of downward sloping demand curves on consumer behavior. As the increased royalty rate is passed-on to consumers at higher rates, the quantity of plays consumed on YouTube falls and revenues are reduced. Consider the royalty revenue effects with a target pass-through elasticity of 0.10. A royalty increase to the on-demand streaming rate of \$0.0079 per play adds \$1.3 billion to the recording industry's revenues, or \$265 million less than the simulation with no pass-through of the cost increase (\$1.6 billion). Increasing the pass-through elasticity to 0.20, so that more of the cost increase is passed on to consumer "prices," results in the industry's revenues rising by \$1.1 billion per year. Even with plausible pass-through rates, the revenue effects are large and exceed one billion dollars annually (at 2015 volume levels, which are low relative to today) for the largest of our royalty changes. Even a modest increase to \$0.0048 per play increases industry revenues by about three-quarters of a billion dollars annually.

F. *Platform Substitution with Full Pass-Through*

If music platforms are substitutes, and they likely are, then as the price of one platform rises, consumers will defect to other platforms. In our model, substitution arises when the demand for subscription streaming services gets more elastic ($\varepsilon_S < -1$). To illustrate, we assume $\varepsilon_S = -1.1$, which provides for relatively mild substitution. Given the low dimension of the model, making the demand more elastic has two effects: (1) it increases overall consumer sensitivity to prices; and (2) makes the platforms substitutes for one another. The results from the simulation across the three royalty rates are summarized in Table 3. (Figures are in millions of dollars.)

Table 3. Royalty Revenue Changes with Substitution Effects

(ε_X = -1.1)

	New Royalty Rate		
	\$0.0017	**\$0.0048**	**\$0.0079**
Pass-through Elasticity 0.10			
Paid Streaming	\$0.48	\$2.46	\$4.28
Ad-Based Streaming	\$0.42	\$2.16	\$3.76
YouTube	\$156	\$767	\$1,288
Total	\$157	\$772	\$1,296
Pass-through Elasticity 0.20			
Paid Streaming	\$0.99	\$4.87	\$8.23
Ad-Based Streaming	\$0.87	\$4.28	\$7.23
YouTube	\$148	\$673	\$1,060
Total	\$150	\$682	\$1,076

Revenues measured in millions of dollars.

In the absence of substitution effects, Table 2 shows that the revenue gain with a pass-through elasticity of 0.10 was \$1.313 billion at a royalty rate of \$0.0079. With substitution, which is mild in this case, the revenue gain falls to \$1,279 billion, a relatively small decline from the \$1,313 in the previous scenario. Platforms other than YouTube account for less than 1% of the revenue change, a result of the relatively small elasticity and pass-through rate. The total revenue effect remains very large, but remains mostly restricted to YouTube. At the higher pass-through elasticity of 0.20, the revenue impact remains over one billion dollars each year, but is smaller than the impacts without substitution.[37] The other platforms now account for 1.5% of the royalty revenue effect, a consequence of higher pass-through.

Naturally, the revenue effects are smaller for smaller increases in the per-play royalty. At a royalty of \$0.0048 per play, for instance, the total annual (for 2015) revenue effects at the two pass-through elasticities are \$772 million and \$682 million, respectively. These are still very large royalty revenue impacts, suggesting the safe harbor is heavily affecting the recording industry by reducing its revenues.

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[37] Depending on the relative royalties and substitution patterns, substitution may actually increase revenues when the royalty rises.

Table 4. Royalty Revenue Changes with Larger Substitution Effects
(ε_X = -1.5)

	New Royalty Rate		
	$0.0017	**$0.0048**	**$0.0079**
Pass-through Elasticity 0.10			
Paid Streaming	$2.39	$12.13	$20.97
Ad-Based Streaming	$2.10	$10.66	$18.42
YouTube	$153	$730	$1,189
Total	$158	$753	$1,229
Pass-through Elasticity 0.20			
Paid Streaming	$4.91	$23.78	$39.46
Ad-Based Streaming	$4.32	$20.89	$34.66
YouTube	$142	$607	$901
Total	$152	$651	$975

Revenues measured in millions of dollars.

In Table 4, we summarize the royalty revenue changes under the assumption of an elasticity of -1.5. In this scenario, the substitution effects will be much larger. At a royalty of $0.0079 and a pass-through proportion of 0.12 (and an elasticity of 0.10 for the largest change), additional royalties are $1,229 million, just a little less than in the previous scenario where ε_S = -1.1 (at, $1,297). This small change—considering the large change in the elasticity—is due in part to the increased substitution to higher royalty paying services. YouTube's rivals account for 3% of the revenue change. At the higher pass-through elasticity of 0.20 (for the largest royalty increase), the total royalty increase is $975 million, with rival platforms accounting for 7.6% of royalty revenue increases. Even with the relatively high elasticity and high pass-through, the royalty revenue impacts are close to one billion dollars per year. With the higher YouTube plays and subscription streaming subscriptions today, we suspect that the revenue effects of YouTube paying the on-demand streaming rate would be in excess of one billion dollars for the recording industry each year at anything close to the on-demand streaming royalty.

Again, the revenue effects remain large, even for a royalty of 0.0048 per play. Assuming a pass-through elasticity of 0.10, the annual revenue effects (for 2015 volumes) is $753 million. At the higher pass-through rate, the effects are $651 million/year in royalties. More rational royalty policies would significantly and positively affect the recording industry, helping it recover from the devastating consequences of the Digital Age and outdated public policies affecting the industry.

IV. Conclusion

In this BULLETIN, we tackle the complex issue of estimating the revenue effects on the recording industry of the safe harbor policy that permits the heavy, on-demand use of recorded music at below market royalties. Simulating royalty rate changes for YouTube, one of the nation's largest purveyors of digital music, we estimate, using 2015 data, that a plausible royalty rate increase could produce increased royalty revenues in the U.S. of $650 million to over one billion dollars a year. This is a sizeable effect, and lends credence to the recording industry's complaints about YouTube's use of the safe harbor.

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