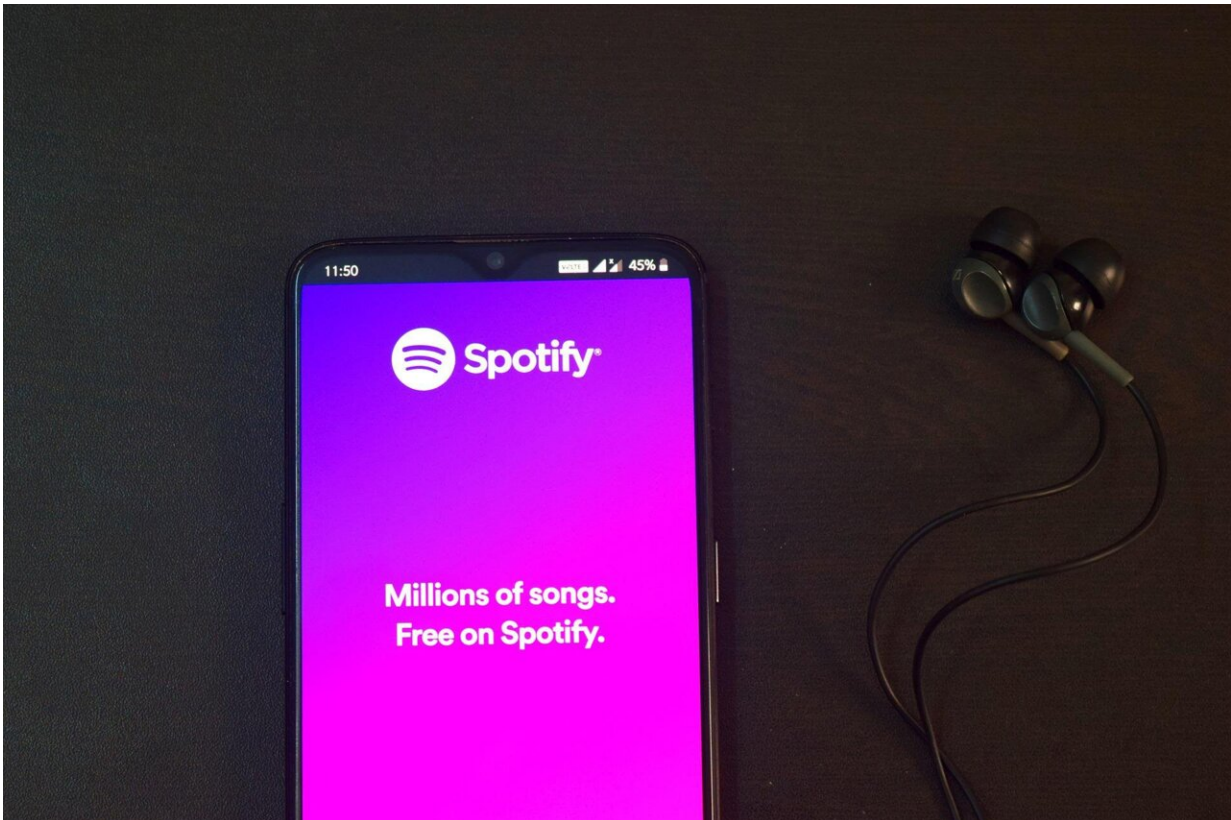


Making music streaming more fair for artists

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The way people listen to music has drastically changed in the past few decades. In a [recent survey](#) of internet users by the International Federation of the Phonographic Industry (IFPI), 78% said they listen to music through streaming services.

The rise of platforms like Spotify, Apple Music, and Deezer has fomented a heated debate on how [content providers](#) get paid for their work. The question of how to optimally distribute the share of users' subscription money allocated to the artists on streaming platforms is a problem that caught the eyes of Saša Pekeč, professor of decision sciences at Duke University's Fuqua School of Business.

Platforms usually allocate a percentage of the subscription and advertising money to content providers—Spotify, for instance, claims that two-thirds of every dollar they make from [music](#) goes to content providers. Two main strategies may be used by streaming platforms to distribute that share. They are called pro-rata and user-centric. Under the pro-rata rule, all the subscription and advertising money is collected in a single pot, and then a percentage of it is distributed to artists proportionally to their number of streams. For example, if Taylor Swift gets five percent of the total streams in a given month, she will get five percent of the total amount of money allocated to content providers in that month. Under the user-centric rule, users' subscription money is distributed proportionally to the artists each user listens to. For example, if one user listens to Yo-Yo Ma exclusively, all of their subscription money allocated to content providers is going to Yo-Yo Ma.

While most of the big platforms adopt the pro-rata rule, the fairness of that strategy is often called into question. Its critics believe it favors superstars and hurts niche artists. This is an open question that economists, academics, and even judges deciding on copyright royalty issues are currently grappling with.

"We saw that there was this interesting discussion and we could see it was actually a math problem," Pekeč says. "So, we started thinking how we could set it up analytically to make that comparison."

Going into the investigation, Pekeč and his co-authors—Saeed Alaei, a

scientist at Google Research, Ali Makhdoumi, also a professor of decision sciences at Fuqua, and Azarakhsh Malekian, a professor of operations management and statistics at the University of Toronto's Rotman School of Management—initially thought they were going to mathematically prove that the pro-rata rule was indeed unfair and bad for small artists.

They were in for a surprise. "That's what drives my interest in research. When something defies common wisdom and I can actually prove it," Pekeč says. Their findings were described in the paper "Revenue-Sharing Allocation Strategy for Two-Sided Media Platforms: Pro-Rata versus User-Centric," which was accepted for publication by the journal *Management Science*.

Pekeč's work is focused on market design, an interdisciplinary field at the intersection of economics, operations research and computer science. "I study economic problems utilizing techniques from optimization and algorithm design," Pekeč explains. "In my research, I'm looking at system-wide design of pricing and allocation—essentially who gets what and at what price—at a large scale. It is about coordination of large markets, which is essentially what platforms do."

Currently the president of the Auctions and Market Design section of the Institute for Operations Research and the Management Sciences (INFORMS), Pekeč is especially interested in [platform](#) business models. He has studied, for example, consumer pricing in ad-supported platforms and the role of bilateral ratings in improving the performance of two-sided on-demand platforms.

Looking into music streaming platforms was a natural interest for him.

Modeling diversity in streaming platforms

To evaluate which revenue allocation strategy was the best, Pekeč and his colleagues worked to develop a model that accurately captured the diversity present on streaming platforms.

"If all of the artists were exactly the same, there would be no difference between these two approaches," Pekeč says. The difference is not only driven by how popular certain artists are among users, but also by how much music each user consumes. "Our model takes both of those things into account: the heterogeneity of how much music people listen to and the heterogeneity of which artists each person prefers."

In the [mathematical model](#), there are different user types based on their overall consumption: some users may listen to a lot of music, getting more for their subscription money, while others may listen to little music. Furthermore, users are also differentiated based on how their listening time is spread over different artists.

In a scenario where there is a fixed set of artists on the platform, when you compare the two revenue allocation rules, you will find that pro-rata does hurt niche artists and benefits superstars. This seems to suggest that the user-centric model is fairer. But that scenario doesn't account for the fact that artists may choose to leave the platform if the rules are not advantageous, potentially taking part of their fanbase with them and impacting the artists who do stay on the platform.

Capturing the complexities of artists' and users' choices

"Our model allows for everybody individually to choose a greener pasture if they can," Pekeč says. With every [artist](#) having the ability to set the optimal price they could get if they offered their music directly to their fans, they can decide if they want to join the streaming platform

under those rules or if they want to go solo. Similarly, users can also decide if they get the best deal by paying for the platform subscription, consuming music directly from their preferred artists, or doing both.

The researchers then asked the question: is the platform better off switching to user-centric or keeping the pro-rata rule? It turns out that, in a scenario where there are artists who are extremely popular among users with high consumption of music, the pro-rata rule is preferred, the study shows. In fact, going with the user-centric approach in that context might not even be sustainable for the platform.

If, on the other hand, there are artists who are extremely popular with low-consumption users, then the user-centric approach might be preferred. However, the pro-rata rule still manages to ensure sustainability even in some such scenarios.

And even niche artists end up benefiting from the pro-rata approach. High-consumption users who join the platform to mostly listen to the superstars may eventually consume niche artists available on the platform. "The niche artists get a level of exposure they would not get otherwise," Pekeč says. "If you think of it that way, then the pro-rata rule is much closer to what should be the mathematically optimal payment rule."

An additional question posed by researchers was: how can streaming platforms choose the optimal set of artists to be on the platform, assuming they will pay these artists at least as much as they could earn if they went solo? This turned out to be a very complex problem known in computer science as NP-complete. For this class of computational problems, no efficient solution algorithm has been found. "We show that finding the optimal set of artists is intractable. Yet we could provide the approximation guaranteed to come very close to the optimal solution," says Pekeč.

Although the largest streaming platforms currently use pro-rata rules to compensate artists, details of those rules are opaque. The paper suggests there is room for improvement, Pekeč notes. "There is an opportunity to do even better for both the [artists](#) and the platform. There is still some value left on the table."

More information: Saeed Alaei et al, Revenue-Sharing Allocation Strategies for Two-Sided Media Platforms: Pro-Rata versus User-Centric, *SSRN Electronic Journal* (2020). [DOI: 10.2139/ssrn.3645521](https://doi.org/10.2139/ssrn.3645521)

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