VIDEO KILLED THE RADIO STAR, DID SPOTIFY KILL THE ROCK STAR? AN ANALYSIS ON HOW STREAMING SERVICES AFFECT THE COMPOSITION OF POPULAR MUSIC

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Abstract

This paper examines previous research claims that streaming services have affected the composition of popular music by causing earlier chorus start times in such. A brief background on streaming services is provided, which leads into the discussion of the findings and methods of the previous research. The hypothesis is then tested in a novel way in which data is collected on 2,487 songs from four Billboard year-end charts dating 2011-2019: "Hot Rock & Alternative Songs", "Hot R&B/Hip-Hop Songs", "Pop Songs", and "Hot Country Songs". These charts were selected as these four genres generated the most revenue for the U.S. music industry from 2011-2019. The musical database is analyzed through summary statistics and a basic regression equation. The paper concludes that the negative effect on chorus start times of hit songs from streaming services is present and statistically significant, but minimal in value. Moreover, the relationship between the chorus start times of pop songs and streaming services is actually positive, opposite of the other three genres, but not statistically significant. On the other hand, the negative relationship between the chorus start times of rock songs and streaming services is both the greatest in value and most statistically significant. This suggests that out of all the most popular genres of music, streaming services are affecting the composition of rock music the most.

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1. Introduction

Throughout history, there has often been mass concern when a new form of technology is on the rise. For example, the increasing popularity of video in the early 1980s, especially with the formation of channels like MTV, caused many to worry that radio would become obsolete. While this certainly was not the case, as radio is still commonly used today, the music industry was forever changed and radio stations were forced to adapt (Starr, 2016). Similarly, today there is widespread concern that streaming services are negatively impacting the music industry and perhaps even the composition of music itself. One of the most common criticisms is that this new technology is lowering the gross revenue of the music industry. This concern stems from the fact that streaming consumers are able to digitally access almost any and as much music as they please at a low cost per month. However, economics professors Luis Aguiar and Joel Waldfogel conclude that the use of Spotify and other streaming services appear to be revenue-neutral for the industry. While these applications do displace permanent music downloads, they also displace music piracy, which is an idealistic secondary effect (Aguiar & Waldfogel, 2018). In fact, this was actually the goal of Spotify in the first place as the company was developed when piracy was a rampant issue impacting the music industry (Lidsky, 2018). In a 2010 interview with the Daily Telegraph, Daniel Ek, CEO and cofounder of Spotify, explained, "I realised that you can never legislate away from piracy…The only way to solve the problem was to create a service that was better than piracy and at the same time compensates the music industry. That gave us Spotify" (Lidsky, 2018).

Jim Rogers, the author of The Death and Life of the Music Industry in the Digital Age, also states, "As a whole [the music industry] has proved itself to be resilient and innovative in responding to the challenges of digitalization" (2013). This is not only true in our current digital

age, but also in the past with other technological improvements. For instance, records used to be one of the main ways the industry made money, but those diminished with the invention of CDs, and in turn, CDs diminished with the invention of downloadable digital music. This is known as the process of "Creative Destruction" (Schumpeter, 2008). Discernibly, as new technology arises, it gradually replaces that which becomes obsolete, but that is not necessarily a negative consequence.

The year 2015 was a major turning point for streaming services. Compared with the previous year, there was a thirty percent increase in revenue from the format of streaming services. Moreover, these profits accounted for the majority of the entire U.S. music industry revenue for the first time ever (Richter, 2016). Undeniably, another pivotal change in the music industry was occurring. Before, music consumption was an ownership-based model, but as streaming services continuously gained popularity, it became an access-based model (Tschmuck, 2017). Additionally, since this turning point in 2015, the music industry had a steady growth of increased revenue every year until 2019 (RIAA, 2020). Evidently, the music industry continues to thrive despite the technological advances and challenges thrown at it. However, could streaming services still be affecting the music industry in some other way, not related to revenue? Many have posed the question, how have streaming services impacted the composition of popular music? More specifically, has this new form of music consumption caused a significant decrease in the chorus start times of popular songs? Previous research claims it does and that the chorus start time of popular songs are now appearing significantly sooner than before. The next section will discuss the findings of this previous research and why it may be the case. This paper then describes how data was collected to test this conjecture in a novel way

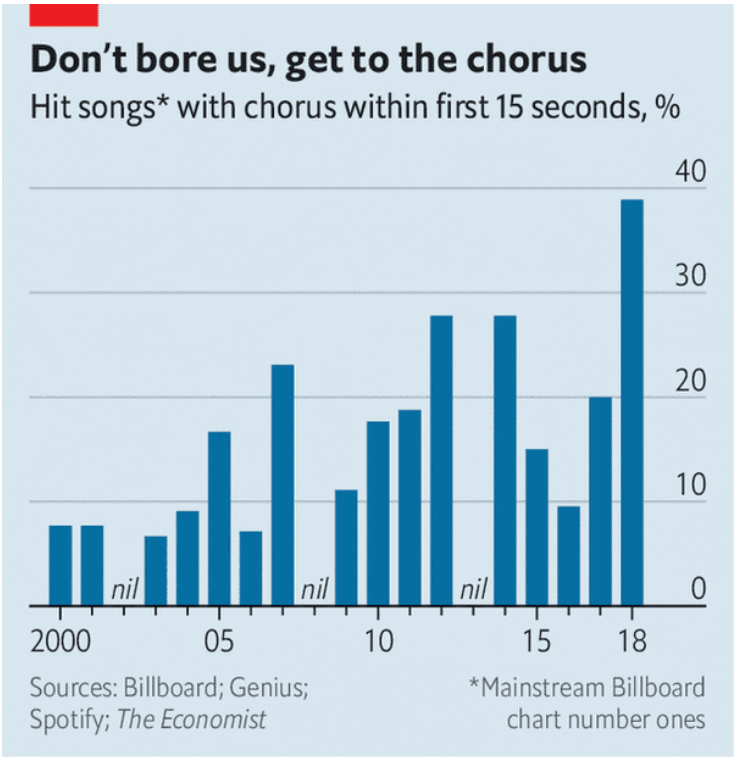
unique to the previous literature. Lastly, the following section will explore the empirical results and the final section concludes and offers areas for future research.

2. Literature Review

The relatively new access-based business model for the music industry has changed the way artists, songwriters, producers, and the likes are paid, and thus their incentives for producing and distributing their music. In 2019, *Verge* editor-in-chief Nilay Patel interviewed songwriter Charlie Harding and musicologist Nate Sloan to discuss these changes and how exactly technology is responsible (Mack, 2019). Harding explains, "Instead of getting paid by physical sales, you're getting paid in a stream, which only counts if someone listens to 30 seconds of a song" (Mack, 2019). Thus, for artists to make a profit from streaming services, their song must quickly catch the interest of the listener so that it is not skipped. The accessible format of streaming services make this an even more difficult feat as subscribed individuals have a seemingly infinite amount of music at their disposal. Rather than leaving a song on because perhaps it is better than what the rest of the radio stations have to offer, a streaming service subscriber can skip as much as they like and for as long as they like, until they find exactly the song they are looking for.

An article from *The Economist* also agrees that "the economics of streaming is changing pop songs...Songs are getting snappier, with shorter intros and earlier choruses" (The Economist Group Limited, 2019). David Israelite, a member of the National Music Publishers Association, further explains that the revenue from a single stream is just "a tiny fraction of a cent", and the songwriter only earns thirteen percent of that (The Economist Group Limited, 2019). Therefore, the song must quickly garner the attention of a large number of listeners for it to be streamed

enough times to even make a decent profit. One way a song can more easily do this is by being "included on a streaming company's playlist" (The Economist Group Limited, 2019). Algorithms automatically select which tracks to include in these playlists, so "composers are adapting to what they think is being looked for. Hit songs are shorter. Intros have become truncated...Choruses are starting sooner" (The Economist Group Limited, 2019). The article includes the following graphic to illustrate this point.



The Economist Group Limited. (2019, October 5). The economics of streaming is changing pop songs. *The Economist. Retrieved October 10, 2019, from https://www.economist.com/finance-and-economics/2019/10/05/the-economics-of-streaming-is-changing-pop-songs.*

This bar graph depicts that the percentage of number one Billboard chart topping songs with a chorus start time within fifteen seconds has drastically increased from 2000 to 2018. However, it is worth noting that only the number one songs are being included, and it is not clear exactly which Billboard charts these songs are coming from. However, David Penn, Founder and

Editor-in-Chief of Hit Songs Deconstructed, conducts similar research specifically on the top ten songs from Billboard's Hot 100 chart (Blume, 2016). This music chart aims to list the most popular 100 songs in the U.S. music industry at a specified time (Reixa & Riley, 2021; Billboard Media LLC, 2021). From his "intensive analysis of virtually every aspect of [these] songs," he arrived at the same conclusion: "songs are getting to the chorus/payoff much faster" (Blume, 2016). While these findings appear to be significant and consistent among multiple sources, the sample size of such is relatively small, as the examined songs were only in the top ten or higher of the Billboard charts. For this reason, I decided to test the idea that choruses of popular songs are starting sooner, but with a much larger and more comprehensive musical database.

3. Data/Empirical Methodology

3a. Pre- vs. Post-Streaming

The analyzed years, that the music was chosen from, were selected by determining the turning point for streaming services. The Recording Industry Association of America's 2015 revenue statistics report states that, "2015 was a milestone year for streaming music. For the first time, streaming was the largest component of industry revenues, comprising 34.3% of the market, just slightly higher than digital downloads" (Friedlander, 2016). Additionally, Apple music, Spotify's main rival, launched in 2015 (BBC, 2018). This provides further evidence that 2015 was the turning point for streaming services as new firms began entering the market due to other's earning a positive economic profit. This trend further continued in 2016 with the arrival of more streaming service companies such as Tidal and SoundCloud Go, proving that this new form of music consumption was here to stay (BBC, 2018). After corroborating that 2015 was in fact the turning point for streaming services, both the prior and subsequent four years were

analyzed. At the time, only data up to 2019 could be obtained, so this cutoff was made in order to keep the number of years examined both before and after streaming became the dominant source of revenue in the music industry as equivalent as possible. Thus, my pre-streaming years comprise of 2011-2014, and my post-streaming years comprise of 2015-2019.

3b. Charting the Songs

The list of songs to gather data on during this nine-year period were entirely based on year-end charts from Billboard for several reasons. First and foremost, the prior research conducted, which inspired my own, focused on songs from the Billboard charts. This is because the company "has been the authority on song popularity since 1940" and continues to remain an important name in the music industry (Reixa & Riley, 2021). Although the Billboard charts are not without their flaws, especially as these technological advances are making it increasingly difficult to chart what is truly most popular, they are the most reliable, comprehensive, and consistent source that was available for my research purposes (Reixa & Riley, 2021). Once firmly settled on using Billboard, the question arose as to which charts would be used to best answer the research question. The Hot 100 chart was first considered, as it is the company's most well-known chart, has its own playlist on Spotify, and is what David Penn used to conduct his research. While using songs from this chart would provide what is most popular and listened to regardless of genre, it made it difficult to consistently categorize each song by genre. This method was experimented with, but as the songs' genres were not explicitly listed on the charts or Spotify, research had to be done on each individual song, and even then, multiple genres would be listed. Thus, I discerned that using genre specific year-end Billboard charts would be the best method, especially since using these charts provided a much bigger and comprehensive

data set, which was one of my initial main goals. Moreover, all the songs on the Hot 100 chart for each year are likely to be on the top genre charts anyway.

There are countless genres and subgenres in existence, so I had to limit my research in some way. I decided to focus on the most popular overarching genres, which required an in-depth analysis of the music industry to determine which genres were consistently most listened to by American consumers. To do this, I obtained Nielsen Music year-end U.S. reports for all nine years, 2011-2019[1]. From these reports, there were four genres that consistently generated the most revenue for the U.S. Music Industry throughout all nine years: rock, r&b/hip-hop, pop, and country (The Nielsen Company, 2012, 2013, 2014, 2015, 2016, 2017, 2018a, 2018b, 2020). Not only did the fifth highest selling genre fluctuate throughout the years, but its consumption percentage was consistently much lower than the other top four. The top four had percentages of total consumption ranging from 7.4% to 31.2%, while the fifth was typically around five percent or lower (The Nielsen Company, 2012, 2013, 2014, 2015, 2016, 2017, 2018a, 2018b, 2020). Therefore, rock, r&b/hip-hop, pop, and country were the four top-selling major genres that were analyzed.

I then obtained the nine year-end genre specific Billboard charts for each of the four genres: "Hot Rock & Alternative Songs" (2011-2019), "Hot R&B/Hip-Hop Songs" (2011-2019), "Pop Songs" (2011-2019), and "Hot Country Songs" (2011-2019) (Billboard LLC, 2021b). All are titled "Hot (Genre Name) Songs" except for Pop because of how the charts are compiled. The "Hot" charts are currently compiled using three pools of data: streaming, radio, and sales. Billboard's website explains, "We use these three pools of data because while the consumer's decision to purchase or stream is a significant vote of popularity, singles have a job that extends

[1] Except 2018, in which I could only find the mid-year report. I had reached out to the Nielsen Company inquiring for the 2018 year-end report, but unfortunately never received a response.

beyond being a sales vehicle: to capture radio play and, hopefully, stimulate album sales" (Billboard Media LLC, 2021a). On the other hand, the "Pop Songs" chart is only compiled based on airplay (Billboard Media LLC, 2021a). For that reason, there was another unfortunate differentiating factor between Pop and the other three genres. Except for the two unique cases of "Hot Rock & Alternative Songs 2011" and "Hot R&B/Hip-Hop Songs 2015", the "Hot" charts all consisted of 100 songs each while the "Pop Songs" only went up to fifty. This is due to the fact that the latter chart evolved from the "Mainstream Top 40" chart which consisted of the most listened to pop songs on the radio (Billboard Media LLC, 2021a). For each song entry from all thirty-six charts, the title, artist, total runtime, chorus start time, year released, respective Billboard chart/genre, and the number on the respective Billboard chart were recorded.

3c. What Constitutes a Chorus

While I felt confident in my knowledge of song structure from having fifteen years of experience as a musician, I wanted to ensure that what I was recording as the chorus start time would be as accurate and consistent as possible for all of the songs in the data set. Therefore, I researched and reviewed the elements of song structure prior to collecting this data. Hit songwriter Jason Blume defines the chorus as, "the most memorable part of the song, both lyrically and melodically—the part people walk away singing" (2016). Additionally, the chorus is often "repeated two or three times", thus it does not present any additional details to the song's story but instead is "a place to summarize the song's essence in a catchy, easy-to-remember way" (Blume, 2016). Another helpful identifying factor is that the lyrics of the chorus usually contain the song's title (Blume, 2016).

In addition to my own thorough understanding of song structure, reinforced by my supplemental research, I utilized the popular lyric website Genius to even further corroborate and confirm exactly each song's chorus. While there are various lyric websites, I enlisted the help of Genius as it is "the world's biggest music encyclopedia with a passionate community of more than two million contributors" (Genius Media Group Inc., 2021). Nonetheless, no website is without its flaws. Occasionally, Genius did not have the lyrics categorized for certain songs, so I either determined the chorus based on my aforementioned research of song structure or found other song specific sources that aided me in determining the chorus[2]. Moreover, in some infrequent cases, I actually disagreed with what Genius determined to be the chorus. For example, "One Kiss" by Calvin Harris and Dua Lipa immediately begins with a quieter version of the chorus. Genius lists this as the "intro" with the chorus not appearing until after this, "verse 1", and the "pre-chorus" (Genius Media Group Inc., n.d.). Nonetheless, the intro *is* the chorus, so I recorded a chorus start time of 0:00 rather than 0:54 as Genius would indicate. Once again, I found other sources to corroborate and confirm this conflicting information when possible[3]. It can be difficult to determine what the songwriter for each unique song designates as the chorus without consulting them directly. Nonetheless, I ensured my database is as accurate as possible by using a comprehensive collaborative lyric website, various online sources specific to songs that posed any difficulties in easily determining the chorus, and my own significant knowledge of song structure, both from being a musician for fifteen years and doing supplemental research on song structure.

[2] (Conaway, 2011); ("Not Again tab by Staind", 2013)
[3] ("Burn chords by Ellie Goulding", 2020); (Cometothepedlar, 2019); (Dukes, 2013); ("Enrique Iglesias - Bailando (English Version)", 2016); ("Go Robot chords by Red Hot Chili Peppers", 2017); (Music-News, 2011); (pureMix Online Inc., n.d.)

I also used Genius to record the song's release year. More often than not, there would be multiple release years listed due to singles being released prior to albums, albums being released prior to singles, and other types of re-releases in an effort to popularize the song and generate more revenue. For my specific research question, I needed to determine the earliest year the song was released. Thus, I used a minimum function to obtain this year from Genius in which I recorded whatever was the earliest year shown between the track's release date and all the albums listed: Year Released = min{Release Date, Album Years}. However, if a song on Spotify had an earlier release year than the song's earliest release year on Genius, or if Genius did not list any years at all, then that year from Spotify was recorded instead. Moreover, whenever there was a discrepancy regarding the track's release date, additional research was conducted with regard to these specific songs to determine the correct year of release[4].

3d. Recording the Chorus Start Time

While my research aims to determine the effects of streaming services on the composition of popular music in general, Spotify was specifically analyzed for a few important reasons. First and foremost, it was the first major streaming service ever developed (de Looper et al., 2021; Lidsky, 2018). Furthermore, it continues to be consistently ranked as the "best music streaming service overall" by various reputable companies, such as Business Insider and Digital Trends, and music experts alike (Bizzaco et al., 2021; de Looper et al., 2021). In fact, in a recent Digital Trends article that breaks down the most popular streaming services, the authors explain that one of the reasons "Spotify ranks supreme" is due to the competition not being able to

[4] (Benét, 2011); (Country 97.1 HANK FM , 2011); (Cunningham, 2021); (Dukes, 2014); (Dunkerley, 2014); (Earls, 2016); (Gibson, 2011); (KALEO, 2014); (NEEDTOBREATHE, 2015); (The Voice TV, 2014); (The Voice 2015 Blind Audition, 2015)

compare (Bizzaco et al., 2021). “With millions more paying subscribers than the closest competition, Spotify is — by a wide margin — the most popular on-demand streaming service on the market” (Bizzaco et al., 2021). Another reason for this mass popularity is that it offers a free, ad-based plan that can be used indefinitely, unlike the rest of streaming services which only include a limited free trial (Bizzaco et al., 2021; de Looper et al., 2021). Thus, in addition to having app support “for all major platforms — including iOS, Android, and your preferred web browser,” Spotify is the most accessible streaming service to everyone (de Looper et al., 2021). For these reasons, Spotify was used to collect all the data on chorus start times and runtimes, specifically with the iOS mobile app.

When a song is selected to play on Spotify, a toolbar appears which allows the listener to play, pause, or skip the song either forwards or backwards. This toolbar also indicates the total runtime on the far right, which was the number used to record the total runtime. Each recorded song was played from the beginning and then paused at the exact moment the first lyric of the determined chorus began. Oftentimes, the chorus seemed to begin exactly between a one second interval. In those cases, the chorus start time was rounded down so as to not miss any part of the chorus. For other songs that were difficult to determine their chorus start time, the play and pause buttons were pressed repeatedly to get the most accurate timestamp possible. Nonetheless, there is unfortunately still an error term of plus or minus one second due to Spotify’s algorithm. While creating the database, the total runtime of various songs would be listed as either one second longer or shorter at a later time than when the song was originally recorded, usually after an automatic Spotify update. This even sometimes affected the start time of the chorus for songs that had previously been recorded. Fortunately, this difference was never greater than one second in either direction and does not appear to systematically affect the data set.

A very specific formula was followed when recording each song's chorus start time to ensure everything recorded was as accurate and consistent as possible. First, I looked up the song on Genius and recorded whatever was first listed as "chorus", unless I explicitly disagreed with this categorization, as explained above. If there were no lyrics labeled as "chorus", but there were lyrics labeled as "refrain" or "hook", I recorded the start time of these lyrics as the terms chorus, refrain, and hook are often used interchangeably. If none of these terms were listed, but the lyrics were still categorized by other song structure elements like intro, verse, bridge, and outro, I determined there was no applicable chorus start time to be recorded. Thus, these songs were removed from my data set. Lastly, if the lyrics were not categorized at all, I determined the chorus on my own, as previously described. Throughout this process, all the chorus start times were based on the very first lyric of the chorus, rather than the first instrumental note. This decision was made to be most consistent in the data collection, especially as some of those instrumental sections prior to the start of the lyrics could be considered the pre-chorus, rather than the actual start of the chorus. That being said, sometimes these long instrumental parts may be a more accurate official start time of the chorus. A good example of such a song is "Hopeless Wanderer" by Mumford and Sons. The switch in the beat and pace of the song occurs instrumentally at 1:35, but the following lyrics do not start until 1:42. Thus, going by my empirical methodology, the chorus start time was recorded at 1:42.

A total of 2,487 songs were included in the musical database. This novel data set was then analyzed through the use of summary statistics and a basic regression equation: Chorus Start Time = $B_0 + B_1$Streaming_DV + B_2Runtime, where Streaming_DV is a binary variable that takes the value of zero for songs released in the pre-streaming era, 2014 and earlier, and takes the value of one for songs released in the post-streaming era, 2015-2019.

4. Empirical Results

The following table contains all of the summary statistics from the database. In addition to all 2,487 observations, the table is also broken down by the four genres: country, pop, r&b/hip-hop, and rock.

All Observations	Before Streaming	After Streaming
Total Observations	1320	1167
Average Runtime (RT) in Seconds	231	214
Average Chorus Start Time (CST) in Seconds	45.41	40
CST as a Percentage of RT	19.68%	18.64%
Observations where CST is <0:30	262	331

Country	Before Streaming	After Streaming
Total Observations	409	320
Average Runtime (RT) in Seconds	217.78	205
Average Chorus Start Time (CST) in Seconds	45	41
CST as a Percentage of RT	20.66%	19.82%
Observations where CST is <0:30	25	33

Pop	Before Streaming	After Streaming
Total Observations	178	157
Average Runtime (RT) in Seconds	227	211
Average Chorus Start Time (CST) in Seconds	38	40
CST as a Percentage of RT	16.79%	18.90%
Observations where CST is <0:30	44	34

R&B/Hip-Hop	Before Streaming	After Streaming
Total Observations	360	348
Average Runtime (RT) in Seconds	245.17	213
Average Chorus State Time (CST) in Seconds	39.46	31.63
CST as a Percentage of RT	16.15%	15.12%
Observations where CST is <0:30	159	205

Rock	Before Streaming	After Streaming
Total Observations	373	342
Average Runtime (RT) in Seconds	235.18	223.89
Average Chorus Start Time (CST) in Seconds	55	47.44
CST as a Percentage of RT	23.40%	21.01%
Observations where CST is <0:30	34	59

From “All Observations”, both the average runtime and average chorus start time have decreased in the post-streaming era by seventeen seconds and 5.41 seconds, respectively. Additionally, the chorus start time as a percentage of the total runtime has also decreased, but only by 1.04%. That being said, there are 69 more observations with a chorus start time appearing in the first thirty seconds of the song in the post-streaming era compared to the pre-streaming era.

For the “Country” genre, all factors decrease from pre- to post-streaming except for the number of observations with a chorus start time less than thirty seconds, similar to the results for “All Observations”. The average runtime decreases by 12.78 seconds, the average chorus start time decreases by four seconds, and the chorus start time as a percentage of runtime decreases by 9.84%. Lastly, there are eight more observations for songs with chorus start times less than thirty seconds, after streaming.

For “Pop”, the average runtime still decreased by sixteen seconds. However, the opposite effects are seemingly occurring for the rest of the factors. The average chorus start time actually increased by two seconds, as well as the chorus start time as a percentage of runtime, which increased by 2.11%. Furthermore, this is the only case where there are actually less observations with a chorus start time less than thirty seconds in the post-streaming era. The number of these observations decrease by ten. That being said, it is worth noting once again that the number of observations for “Pop” are significantly smaller than the other three genres, due to the differences in the Billboard charts. Additionally, these songs were based solely on airplay popularity, rather than pooling from all three areas of data (streaming, radio, and sales) like the other genres. These factors may account for some of the stark differences with this genre compared to the others.

"R&B/Hip-Hop" follows the typical trend from "Country" and "All Observations". The average runtime decreases by 32.17 seconds, the average chorus start time decreases by 7.83 seconds, and the chorus start time as a percentage of the runtime decreases by 1.03%. Moreover, there are forty-six more songs in the post-streaming era that have a chorus start time falling under thirty seconds.

Lastly, "Rock" once again follows the typical trend, but this genre appears to have the overall most significant effects from streaming. While the average runtime, average chorus start time, and chorus start time as a percentage of the runtime only decrease by 11.29 seconds, 7.56 seconds, and 2.39%, respectively, the observations with a chorus start time less than thirty seconds almost doubles. Although there are only twenty-five more of these observations, this is a big jump compared to the pre-streaming era with only thirty-four of these observations.

In addition to these summary statistics, this data was also analyzed with an ordinary least squares (OLS) regression using the following equation: Chorus Start Time = B_0 + B_1Streaming_DV + B_2Runtime.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	cst_sec	cst_sec	cst_sec	cst_sec	cst_sec
Streaming_DV	-2.303**	-1.918**	3.447	-4.784***	-3.903*
	(0.919)	(0.852)	(2.091)	(1.595)	(2.216)
rt_sec	0.186***	0.196***	0.115***	0.258***	0.121***
	(0.0183)	(0.0228)	(0.0293)	(0.0280)	(0.0271)
Constant	2.344	2.302	11.81*	-5.495	9.887
	(4.132)	(4.880)	(6.674)	(6.448)	(6.514)
Genre	All	Country	Pop	Rock	RBHH
Observations	2,487	729	335	715	708
R-squared	0.132	0.242	0.055	0.297	0.055

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table consists of five different regressions which all run the streaming binary variable (Streaming_DV), equal to one for all observations released in the year 2015 or later and equal to zero otherwise, on the dependent variable chorus start time in seconds (cst_sec), while controlling for runtime in seconds (rt_sec). The first regression uses all the observations, regardless of genre, while the rest are genre specific. This first regression (column 1) tells us that streaming services have had a statistically significant negative effect on the chorus start time of popular songs. Compared to the pre-streaming era, hit songs released in the post-streaming era have a sooner chorus start time by 2.3 seconds, on average, controlling for runtime. Evidently, this effect is relatively small and contrasts the findings from the prior research that there is a drastic difference in the composition of popular music as a result of streaming services. Looking at the other four regressions (columns 1-4), there is also a statistically significant negative relationship between streaming services and chorus start time for all genres, except for "Pop". While "Pop" does have a positive relationship between these two variables, it is not statistically significant. Once again, this may be due to the fact that the number of "Pop" observations were almost half that of the other genres.

On the other hand, streaming services appear to have had the biggest impact on rock music (column 4). Compared to the pre-streaming era, hit rock songs in the post-streaming era have a sooner chorus start time by 4.78 seconds on average, controlling for runtime. This coefficient is also the most statistically significant, indicating that the composition of this genre has been affected the most. For the other two negatively correlated genres, "Country" and "R&B/Hip-Hop", their chorus start times decrease by 1.92 seconds and 3.9 seconds on average, respectively, controlling for runtime.

Top 10 Songs

VARIABLES	(1) cst_sec	(2) cst_sec	(3) cst_sec	(4) cst_sec	(5) cst_sec
Streaming_DV	-1.524	-0.576	6.570	-9.237	-2.365
	(2.911)	(2.206)	(4.586)	(5.941)	(8.831)
rt_sec	0.146***	0.174***	0.0913***	0.157*	0.205*
	(0.0467)	(0.0344)	(0.0316)	(0.0865)	(0.104)
Constant	10.66	4.826	16.30*	15.36	-4.694
	(10.71)	(8.058)	(8.740)	(19.45)	(25.46)
Genre	All	Country	Pop	Rock	RBHH
Observations	274	81	67	58	68
R-squared	0.079	0.208	0.057	0.132	0.107

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Not Top 10 Songs

VARIABLES	(1) cst_sec	(2) cst_sec	(3) cst_sec	(4) cst_sec	(5) cst_sec
Streaming_DV	-2.420**	-2.074**	2.588	-4.552***	-4.235*
	(0.969)	(0.919)	(2.364)	(1.663)	(2.213)
rt_sec	0.190***	0.198***	0.124***	0.261***	0.108***
	(0.0195)	(0.0247)	(0.0409)	(0.0288)	(0.0268)
Constant	1.522	2.061	10.24	-6.050	12.35*
	(4.393)	(5.267)	(9.103)	(6.664)	(6.413)
Genre	All	Country	Pop	Rock	RBHH
Observations	2,213	648	268	657	640
R-squared	0.138	0.247	0.057	0.308	0.049

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

These two tables run the same regressions as before, however, the first table only includes songs from the top ten of all the Billboard charts, while the second table includes everything except the top ten. These regressions were run to determine if the composition effect of streaming services was more prominent on the hit songs at the very top of the chart, as the prior research suggested. However, none of the streaming variable coefficients in the first table

are statistically significant. In contrast, all of the streaming variable coefficients in the second table, other than "Pop", are statistically significant and very close in value to the original table. Thus, the change in popular music composition is not focused on the top of the chart, as suggested by prior research. These results provide evidence to support that while the composition of popular music does appear to be changing in response to the increasing usage of streaming services, it is not changing as radically as suggested by previous research. Furthermore, these changes do not appear to be concentrated in the songs that are topping the charts, which is also contrary to past research.

5. Conclusion

Although prior research suggests that streaming services have greatly impacted the composition of popular music by causing choruses to begin much sooner, I have found these effects to be present, but minimal. For all 2,487 hit songs from the top four genres (pop, rock, r&b/hip-hop, and country) of 2011 through 2019, the average chorus start time only decreased by 5.41 seconds for the songs released during and after 2015, the turning point year for streaming services. Additionally, from running an ordinary least squares regression on all of these observations that controlled for total runtime, popular songs that were released in the post-streaming era have a sooner chorus start time by 2.303 seconds, on average, compared to popular songs released in the pre-streaming era. Moreover, chorus start times do not further decrease as a song's popularity increases, despite previous research observing stark differences among chart-topping songs. Other than "Pop", which had significantly less observations than the other three genres, each genre followed this trend with small decreasing chorus start times, all less than five seconds.

Of these four most listened to genres, streaming services have had the greatest effect on rock music with choruses appearing 4.784 seconds sooner for rock songs released during the post-streaming era, again controlling for runtime. This negative relationship between streaming and the chorus start times of popular rock songs is also the most statistically significant out of all the streaming coefficients. Additionally, the amount of rock songs with a chorus start time under thirty seconds almost doubled from the pre-streaming era to the post-streaming era.

It is possible that the reason rock music has been most affected by streaming services and pop music least affected by streaming services is due to the nature and origin of these genres. For instance, rock songs are often known for long introductions and guitar solos, while pop music has consistently aimed to be catchy and likeable to a mass audience. Future research could be done to prove or disprove this conjecture, but nonetheless, the usage and popularity of streaming services are changing the composition of rock music the most, in comparison to other popular genres. While streaming services do not appear to be exceptionally affecting music composition as a whole, perhaps Spotify has killed the rock star that we used to know.

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