A Look at Streaming and Globalization of Regional Popular Music Using Spotify's Audio Features

by

Kyle Haas

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Nicholas Proferes, Chair
Alexander Halavais
Shawn Walker

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ABSTRACT

Music is an integral part of a community's identity, and music streaming has changed the way in which people interact with popular music as a whole. While significant research has been done regarding how streaming services have impacted the way users engage with music, little has been done to account for how streaming has changed the creation of new music. Additionally, globalization in music results in unique hybrid genres rather than complete adoption of global culture, making it hard to measure the global impact on regional sounds, as chart diversity alone cannot account for this unique interaction. This research addresses this gap in literature by utilizing Spotify's audio features to analyze regional popular music characteristics from 2010 through 2020 using the Top 100 tracks from the global, Korean, and Japanese charts. It then observes whether the chart data demonstrates a convergence or divergence in relation to the musical attributes of global popular music and the growth of music streaming, and if it is reflecting a globalization effect. The results suggest that local artists reflect global trends in already globalized markets, and that streaming may be having a heterogenization effect on popular music. Additionally, the data also suggests that observing the musical characteristics of a region may be able to measure how globalized a region's music culture is, allowing for the observation of globalization beyond looking at chart diversity and instead observing the music characteristics of domestic artists.

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CHAPTER 1

INTRODUCTION

Throughout history, music has been an important piece of culture and a pillar of expression within communities, and that is why it is important to understand the influence that algorithmically driven distribution platforms and globalization are having on music creation. Recent years have seen a number of studies focused on understanding how algorithms on platforms such as Spotify impact the diversity of a user's listening habits, as well as examining the phenomenon of globalization as it relates to popular music trends, but little has been done to study the change this has had on the music being produced. While many researchers have attempted to understand globalization in popular music, it often demonstrates itself as a fusion of global and local culture, making it more difficult to observe compared to other forms of globalization. With streaming platforms taking over the music market, the topic of globalization of music is as important now as it ever has been as users and artists across the world have greater access to global sounds than ever before. These factors combined make examining the intersection of streaming and globalization timely, as the novel nature of these platforms as well as its global reach poise music streaming to increase the impact of globalization on local music cultures. With that in mind, this research examines the tonal characteristics of popular music by leveraging the song analysis within Spotify's algorithm in an effort to observe whether the musical attributes of regional popular music demonstrate a convergence or divergence in relation to the musical attributes of global popular music, and if it is reflecting a globalization

effect. Further, do changes in the characteristics of popular music correlate with the growth of music streaming itself?

CHAPTER 2

LITERATURE REVIEW

Globalization

Globalization can be summarized as the increased availability of foreign cultural goods and media, as well as the adoption or integration of the foreign into local culture and products (Verboord & Brandellero, 2018). Ritzer explains that globalization "consists primarily of two major directional tendencies, increasing global connectivity and increasing global consciousness" (Ritzer, 2007 p.64), and it has been observed that since the 1960's, music charts have been increasingly globalized over time with an ever-increasing presence of foreign artists in smaller music markets (Verboord & Brandellero, 2018; Bello & Garcia, 2021). Typically, when this kind of intersection of local and global culture occurs there is an adoption of the global at the expense of local culture, but music is unique in how it reacts to this exposure and doesn't result in the typical overriding of local cultural trends.

With cultural expression through music being a fundamental form of community identities, Hall and Du Gay describe the process of globalization of local forms of music as "a form of cultural 'genocide'" (2011, p. 108), while others argue that local culture reemerges through the process (Garofalo, 1993; Ho, 2003; Achterberg et al., 2011). Streaming services have opened the door for the global community to experience various cultures through the sharing of music, but there is the possibility that these same services are acting as catalysts for the globalization of local sounds, with international artists and musical trends

overwhelming and smothering local music culture. While streaming has reported increases in overall listening diversity for users since the shift away from physical mediums (Bello & Garcia, 2021), the lack of convergence in current literature does not act as evidence to say that a form of globalization isn't present. The unique interaction of music with globalization can lead to the integration of global influences into local culture, creating new local sounds infused with global trends (Garofalo, 1993; Ho, 2003; Oh, 2013). As a reaction to global influence, domestic artists infuse elements of global popular music into the already popular local music trends to create fusions reflective of both global and regional cultures. Because of this phenomenon, it becomes more challenging to identify the process of globalization within popular music since it comes as this fusion of culture rather than a complete adoption of the global.

Another challenge for understanding the impact of globalization in popular music is that music trends tend to be fluid and evolve over time naturally. Therefore, it must be acknowledged that changes in a market may be part of natural trajectories rather than global influence (Zhang & Fung, 2019). So, while it may be too bold as to say that streaming is causing the globalization of popular music, it is reasonable to suggest that algorithm-based platforms facilitate and catalyze this globalization and may be speeding up the current trajectories of regional popular music.

Music, Streaming, and Diversity

Streaming services have transformed the medium in which users interact with music by increasing availability and exposure to music culture to new levels, and with that shift has come drastic changes to the stability of the music industry as artists have found greater discoverability but have a harder time staying in a user's listening catalog (Datta et al., 2018). Since 2010 streaming has seen steady growth year over year as a medium and has exploded to a dominant 62% market share in 2020 (IFPI, 2021).

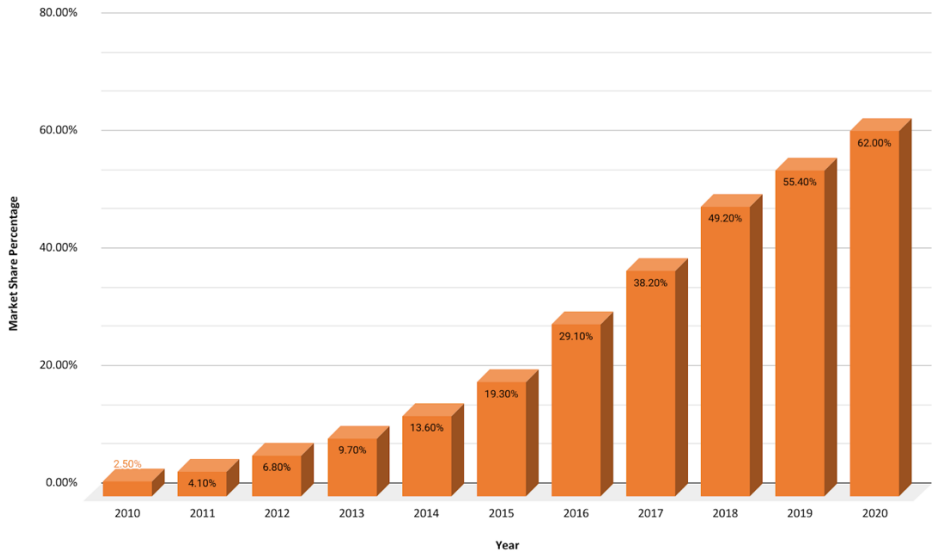

Figure 1. Music Streaming Market Share as reported in the IFPI 2021 Global Music Report

The new digital age of music distribution has created a "highly volatile market, resulting regularly in heterogeneous charts" (Jovanovska et al., 2020 p.2), which may be encouraging artists to change approaches in order to please the platform algorithms to increase the likelihood of the success and longevity of their music

as digital charts have a higher volatility than their physical counterparts. This same heterogeneous effect is seen on the user's listening diversity, as research has shown that streaming has increased the overall listening diversity of listeners (Bello & Garcia, 2021; Datta et al., 2018). However, within streaming platforms user consumption by algorithmically generated suggestions results in lower amounts of diversity compared to users that reduce algorithm-driven consumption and rely on user-initiated searches (Anderson et al., 2020). With platforms such as Spotify hosting over 70 million songs and adding over 60,000 every day (Iqbal, 2018), getting an artist's music discovered is a challenge in an overpopulated listening environment. Founded in 2006, Spotify has developed into one of the most popular streaming platforms in the world, with usership climbing to over 365 million in 2021, and while there are a number of platforms that make up streaming's market share, Spotify is easily one of the farthest-reaching platforms in the world. With a presence in over 171 markets (Iqbal, 2018), and having added over 80 in 2021 alone (Spotify Expands International Footprint, 2021), Spotify is one of the largest and most used platforms with which to examine the relationship between streaming and globalization. The catalog size and international reach of streaming services such as Spotify create the perfect environment for the globalization of local music cultures, as music streaming continues to grow as the primary medium for distribution. Additionally, algorithmically generated suggestions and curated playlists are key components of discoverability as the volume of content continues to grow in streaming platforms,

making it increasingly difficult for domestic artists to compete with globally popular music.

What all these factors combine to create is an extremely diverse, yet volatile listening environment. To put it simply, users are listening to more artists, but for less time. Artists have a greater chance of making it into a user's library of songs, but have a harder time staying in a user's rotation, as songs fall off the digital charts quicker than physical. While user's have greater variety in the kinds of music they listen to due to the volume of songs that are available through streaming, platform algorithms tend to reinforce user listening habits and limit exposure to artists that don't fit within the users listening history as the oversaturation makes discovering new music . As a result, it is only natural that domestic artists would look to the global trends they are now competing with in order to find commercial success. As research into platforms such as Spotify continue, it is important to look beyond the impact it has on the singular user and observe the broader contexts that algorithm-based platforms can influence in order to better understand how streaming may potentially impact cultural identities in music.

Regions

The global music market accounts for close to 26 billion dollars of revenue each year, and 65% of that revenue now comes from streaming services (*Industry Data*, 2021), with Spotify having emerged as the biggest platform in this new distribution landscape. As streaming has become the primary medium for

listeners, Korea and Japan's domestic music market have taken quite different approaches to this new normal. The K-Pop phenomenon has taken the global market by storm in recent years, with K-Pop artists breaking out of the regional market into the global charts with increasing frequency. K-Pop has existed in the periphery of the global music market for quite some time (Oh, 2013), but only in the last decade has it started to achieve consistent success outside of the domestic market with its catchy sounds and viral choreographed performances (Romano, 2018). On the other hand, while streaming has become the primary mode of consumption in almost every major market, Japan remains an outlier with physical CD sales still making up 70% of total revenue in 2019 (Ingham, 2020), while also being the second largest music market next to the United States (IFPI, 2021). Japan's music charts are dominated by domestic artists, with only the occasional viral hit making its way onto the charts from the global market (Ingham, 2021). Recent years have seen Japan slowly shift towards streaming, partly due to the pandemic, but until now this market has remained largely isolated from global trends. This makes it an ideal region to examine as streaming begins to gain popularity. Within these regions, there are a multitude of services that make up the streaming market, and while international powerhouses such as Spotify have a presence, there is a wide distribution among services, with local providers being the regional industry leaders in many places. Regardless of this platform diversity, the fact remains that the explosive growth of streaming platforms has increased user exposure to popular global sounds at an exponential

rate, with platforms often pushing various global trends via the algorithms of the platform.

Through examining existing literature, it is evident that the globalization of regional sounds is a phenomenon where the local and global sounds of the day collide, and researchers fail to agree whether this process is positive or negative to local cultures. A current difficulty lies in how to gauge how “globalized” popular music is in a region, since it demonstrates itself as a fusion of global sounds and local culture. Streaming services have taken over the global market at a remarkable rate over the past decade, and regional markets have received this growth in very different ways, directly impacting the evolution of the region's music. With a primary feature of streaming platforms revolving around the use of algorithms to generate content for the user, it needs to be asked how these platforms are influencing the established trends of popular music within these regions. All of these factors create a perfect storm in impacting regional sounds and potentially encouraging the globalization of music that represents a key form of cultural identity for many communities.

While examining the globalization of popular music in regions has been investigated by many researchers before, it remains important to continue examining the phenomenon as new platforms in the field emerge and the global framework continues to evolve, and this research aims to address and build upon what other research has observed. The aforementioned reemergence of local culture through the globalization of music creates challenges in researchers' ability to accurately examine how globalized a market is. Many traditional

methods focus on regional charts and chart diversity to determine how globalized a region is (Achterberg et al., 2011; Bello & Garcia, 2021; Verboord & Brandellero, 2018), but if globalization is manifesting itself through domestic artists and the fusion of global sounds with traditional local genres (Garofalo, 1993; Ho, 2003; Achterberg et al., 2011), then this approach would fail to capture the scale of globalization when it is represented through the music of the domestic artists. Examining the core characteristics of music over time may offer the ability to quantify the globalization of a market in a way other than simply examining the diversity of music charts, offering a more complete insight into the impact of globalization in regional markets.

CHAPTER 3

METHODS

Having identified the ways in which globalization interacts with popular music, it is clear that the way it exhibits itself is unique compared to other cultural products, as it fuses with local culture rather than the global products overtaking the local. With that in mind, simply examining chart diversity between local and international artists is unable to fully capture the scope of globalization. In order to account for this, we will once again look towards chart data, but instead of looking at the diversity of artists, we will instead observe the fundamental musical characteristics of the songs from global and regional charts by utilizing Spotify and the audio analysis it performs on uploaded songs. Spotify, as mentioned in the previous section, is one of the largest streaming platforms in both user base and global reach, and while it may not be the streaming leader in every market, it's fair to assume that using Spotify for this analysis is reasonably representative of the global community's interactions with streaming. Additionally, Spotify provides greater access to the information they use in their recommender system than most other streaming platforms, and their API is open to anyone, making the data used in this analysis easily repeatable for ongoing observation.

From the accessible data that Spotify provides, the “Audio Features” is what will be examined, and these are a series of metrics that they generate through the audio analysis performed on uploaded tracks that serve as the numeric representation of what the overall feel of a song is like. The numeric values that are generated through this process are key parts of the recommender system that

Spotify employs and represent various aspects of a track's properties. What observing these variables allow for is the comparison of key artistic elements of song construction. Since these metrics aim to describe the holistic “sound” of a track through multiple variables, it allows us to capture the essence of global trends and see if popular global sounds have any bearing on the characteristics of regional music trends. The metrics cover a range of components that could be loosely grouped up into three sets, with the first set dealing with standard musical characteristics such as key, tempo, whether a track is in a major or minor key, and loudness levels. Secondly, there is a set of variables that represent Spotify’s confidence level about particular characteristics of a song, such as whether it is a live performance, whether it is an electronic or acoustic song, or if it is an instrumental track. Lastly, there are variables that Spotify generates by a combination of some of the previously mentioned metrics and other results from their audio analysis process, and features such as danceability, energy, and valence are quantified out of it. While most of these variables will be observed in their relationship to their regional counterparts and the growth of streaming, valence and mode will also be compared for links between the two variables. As seen in Table 1, valence is described as the measure of the positiveness that a track conveys, which is closely related to mode in that mode is observed to have a significant impact on the perceived emotional undertones that music conveys (Hunter & Schellenberg, 2010). It is also important to note that the range of data Spotify provides is broad and some of the data can be somewhat deceiving. Mark Koh, an engineer working on Spotify’s recommender system, warns that

understanding which features are simply returning confidence levels rather than a full range metric is key in drawing accurate inferences from the data (Koh, 2018). While there are some basic track identifiers in the returned features, the majority are focused at defining the key features of the song, and are described in Table 1 as explained on Spotify's developer site (Web API Reference | Spotify for Developers, 2022).

Table 1

Spotify Audio Features Definitions

Feature	Definition
Acousticness	A confidence measure from 0.0 to 1.0 of whether the track is acoustic. 1.0 represents high confidence the track is acoustic.
Danceability	Describes how suitable a track is for dancing based on a combination of musical elements including tempo, rhythm stability, beat strength, and overall regularity. A value of 0.0 is least danceable and 1.0 is most danceable.
Energy	Energy is a measure from 0.0 to 1.0 and represents a perceptual measure of intensity and activity. Typically, energetic tracks feel fast, loud, and noisy. For example, death metal has high energy, while a Bach prelude scores low on the scale. Perceptual features contributing to this attribute include dynamic range, perceived loudness, timbre, onset rate, and general entropy.
Instrumentalness	Predicts whether a track contains no vocals. "Ooh" and "aah" sounds are treated as instrumental in this context. Rap or spoken word tracks are clearly "vocal". The closer the instrumentalness

	value is to 1.0, the greater likelihood the track contains no vocal content. Values above 0.5 are intended to represent instrumental tracks, but confidence is higher as the value approaches 1.0.
Key	The key the track is in. Integers map to pitches using standard Pitch Class notation. E.g., 0 = C, 1 = C♯/D♭, 2 = D, and so on. If no key was detected, the value is -1.
Liveness	Detects the presence of an audience in the recording. Higher liveness values represent an increased probability that the track was performed live. A value above 0.8 provides strong likelihood that the track is live.
Loudness	The overall loudness of a track in decibels (dB). Loudness values are averaged across the entire track and are useful for comparing relative loudness of tracks. Loudness is the quality of a sound that is the primary psychological correlate of physical strength (amplitude). Values typically range between -60 and 0 db.
Mode	Mode indicates the modality (major or minor) of a track, the type of scale from which its melodic content is derived. Major is represented by 1 and minor is 0.
Speechiness	Speechiness detects the presence of spoken words in a track. The more exclusively speech-like the recording (e.g., talk show, audio book, poetry), the closer to 1.0 the attribute value. Values above 0.66 describe tracks that are probably made entirely of spoken words. Values between 0.33 and 0.66 describe tracks that may contain both music and speech, either in sections or layered, including such cases as rap music. Values below 0.33 most likely represent music and other non-speech-like tracks.

Tempo	The overall estimated tempo of a track in beats per minute (BPM). In musical terminology, tempo is the speed or pace of a given piece and derives directly from the average beat duration.
Time Signature	An estimated time signature. The time signature (meter) is a notational convention to specify how many beats are in each bar (or measure). The time signature ranges from 3 to 7 indicating time signatures of "3/4", to "7/4".
Valence	A measure from 0.0 to 1.0 describing the musical positiveness conveyed by a track. Tracks with high valence sound more positive (e.g., happy, cheerful, euphoric), while tracks with low valence sound more negative (e.g., sad, depressed, angry).

Note. From *Spotify for Developers* (2022)

For the scope of this research, chart data from 2010 through 2020 will be compiled and analyzed. Streaming first started to emerge on the scene in 2005, but failed to gain momentum as a medium until 2012, and this transition is present in revenue data from both the International Federation of the Phonographic Industry (IFPI) and the Recording Industry Association of America as seen in Figure 2 (RIAA) (*IFPI Global Music Report 2022*, 2022; *U.S. Sales Database*, 2022).

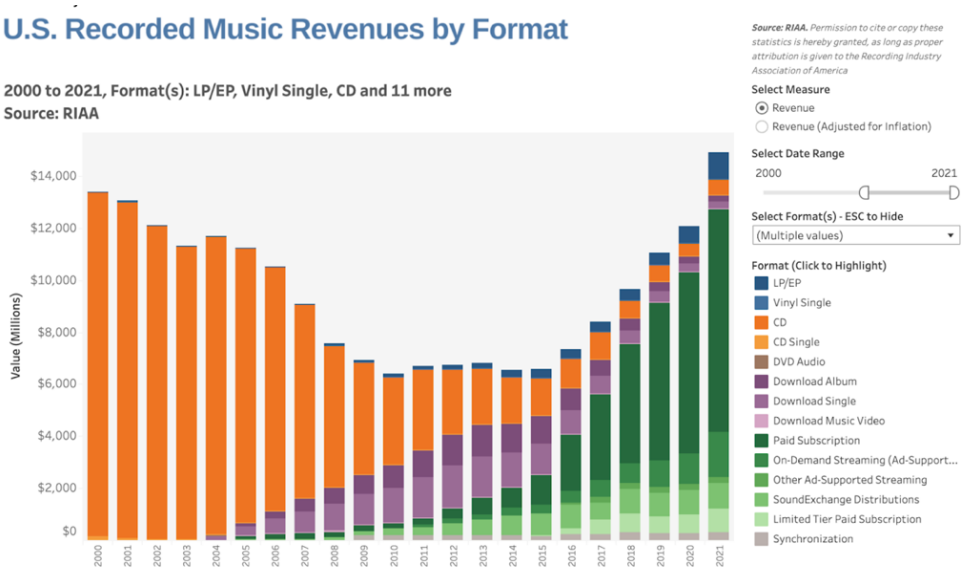

Figure 2. Revenue by format in the United States according to the RIAA (U.S. Sales Database, 2022).

By selecting 2010 as the starting point of the data set it precedes any significant presence streaming services had in the music industry.

Since Japan and Korea have strong regional genres as well as sizable presences in the music industry, observing these in contrast to the global offer ideal circumstances to draw correlations between. From Korea, the dataset includes each year's top 100 tracks as listed by regional Circle Digital music charts (recently rebranded from the Gaon digital chart). The Circle Digital chart tracks the top 200 songs on a weekly/monthly/yearly basis, and is compiled by factoring in streaming, downloads, and background music sales (*Circle Chart*, 2022). Japan's data is constructed using the regional Oricon music charts, which primarily reference the physical sales of singles and albums to generate their yearly top 100 ranking (*オリコンの音楽(シングル、アルバム)・映像（DVD*

、*Blu-Ray Disc*）ソフトランキングについて, 2022). In this regard, the regional data sets are constructed by referencing local industry standard charts that focus on each region's primary mode of consumption, with Korea's Circle Digital chart focusing on digital sales and Japan's Oricon focusing on physical sales. The last chart is the Billboard Yearly Hot 100, which reports the top 100 singles in the United States using radio play, sales data, and streaming data ("Hot 100 Songs," 2013). Billboard charts have acted as the standard for a track's international success for decades, and while there is a Billboard Global 200 chart, it only launched in 2020 making it unusable for the scope of this study.

It is important to detail some omissions and inclusions in regards to the top 100 singles from the Oricon Singles chart. The Oricon chart differs slightly from the Circle and Billboard charts due to the use of physical sales as the reference point, as singles in Japan can commonly contain multiple songs in the form of a very short album. When this happens, there are typically 2-3 featured tracks, and at times there will be additional instrumental versions and alternate mixes as well. In order to maintain the focus of the data set, the following criteria were implemented in deciding which songs to include/omit. Firstly, if the Oricon chart only mentions one song, then that is the only song grabbed regardless of what other tracks are on the album so long as a song of that title is on the record. If the chart listed multiple songs (which was common), all were added to the data set. Secondly, all instrumental versions and alternate mixes were omitted. Lastly, if the single listed on the chart did not match the name of any tracks on the aforenamed album and instead referred to the entirety of the single record, then all

songs from the single were added to the data set minus instrumental versions and alternate mixes. It is also important to note that due to the lack of popularity of streaming in Japan, there are a handful of publishers that have yet to make their artist's music available on Spotify. Due to this, the data sets for Japan are slightly smaller and do not contain all 100 tracks from the Oricon chart each year.

The final set of omissions are specific to the regional charts in relation to globally popular music. Since this research is designed to understand the impact of streaming on regional popular music and the globalization said markets, globally popular tracks were omitted from the regional datasets in order to keep the data focused on the characteristics of the music produced by each region. The exception is when a regional artist managed to reach the global charts, and in that case the track remained in the regional data set as it was still representative of the region's musical characteristics. To give an example, if Ed Sheeran's Shape of You charted in both the global charts and the Korean charts, it was excluded from the Korean data set, however if BTS's Permission to Dance charted in both data sets, it remained in both. This omission was rarely implemented as each chart was largely heterogeneous.

CHAPTER 4

DATA

Chart data was constructed into playlists on Spotify, with each year-end chart being summed into its own playlist. Track features were extracted via Python using the Spotipy library to access Spotify's API. Each playlist was then iterated over and the audio features for each track were compiled into data frames representing each year for each region, resulting in a total of 33 data sets, one for each year for each region (Global, Korea, and Japan). Once the audio features data was compiled, descriptive statistics were generated to understand trends of the data (available in Appendix A), and correlations between different regions were determined by using the Spearman's Rho test. Spearman's Rho was used to firstly determine correlation in trends between the global variable and the regional markets, and secondly between streaming market share and the music characteristic variable. In some instances, Spearman's Rho was used to compare correlation between specific musical characteristics for reasons that will be discussed later in this section. These correlations inform us as to whether year over year changes in the regional musical trends are possibly connected to the changes in global trends and streaming growth, or are independent of the influences from these factors.

Danceability

The first variable is that of a song's perceived danceability, as interpreted by Spotify through several variables (such as tempo and rhythm stability) during the

song analysis process. Here, we see that year-to-year Japan remains fairly consistent in its mean level of danceability, while the levels of the Global and Korean initially hold similar patterns before diverging from one another over time, as demonstrated in Table 1.

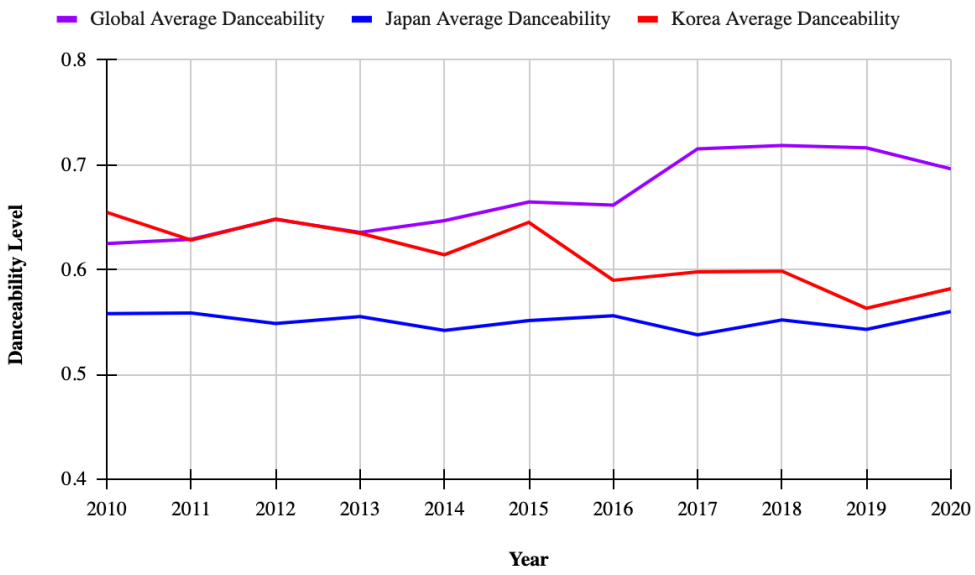

Figure 3. Average Danceability by Year

Spearman's Rho was used to examine whether there was any statistically significant correlation between regional markets' danceability levels, as well as danceability and streaming's market share growth.

Spearman's rank correlation test showed a statistically significant negative correlation between the average yearly global danceability level and the average yearly Korean danceability levels, $r(8) = -.66$, p (2-tailed) = .026. There was no significant correlation between the average yearly global danceability level and the average yearly Japanese danceability level, $r(8) = -.38$, p (2-tailed) = .247.

In terms of connection with global streaming market share, there was a statistically significant positive correlation between the music streaming's global market share and average danceability in the Global charts, $r(8) = 0.9$, p (2-tailed) = .000. There was a statistically significant negative correlation between the music streaming's global market share and average danceability in Korea's charts, $r(8) = -.84$, p (2-tailed) = .001. Lastly, there was no significant correlation between music streaming's global market share and average danceability in Japan's charts, $r(8) = -.16$, p (2-tailed) = .631

Energy

The second variable is energy, which is another Spotify defined variable combining multiple attributes (such as dynamic range and timbre). Through examining the mean energy levels representative in the chart data, energy demonstrates yet again that Japan holds a strong level of consistency, whereas the Global and Korean datasets exhibit a downward trend that are almost identical to one another.

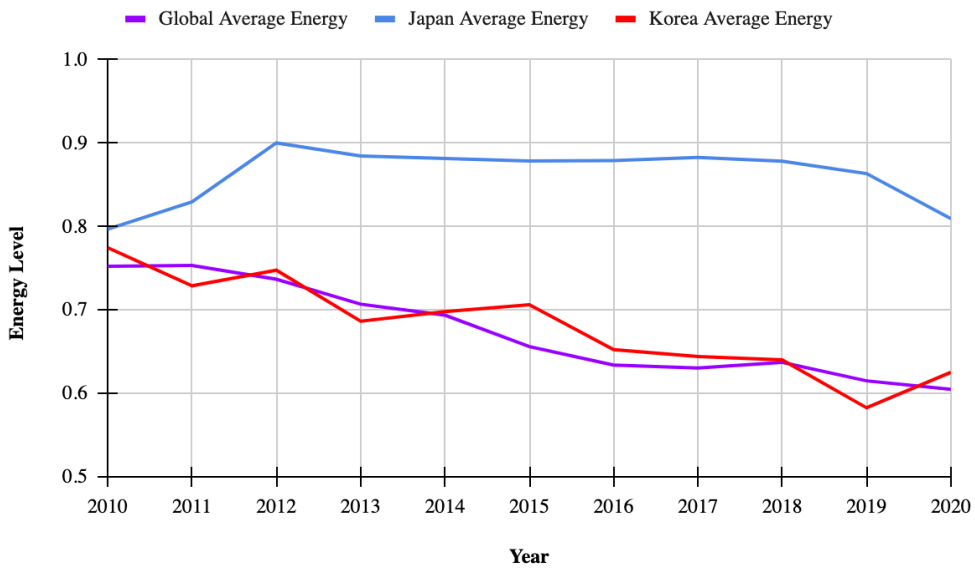

Figure 4. Average Energy by Year

Spearman's Rho was used to examine whether there was any statistically significant correlation between regional markets' energy levels, as well as energy and streaming's market share growth. Spearman's rank correlation test showed a statistically significant positive correlation between average global chart energy and average energy in Korea's charts, $r(8) = 0.9$, p (2-tailed) = .000. There was no significant correlation between the average global chart energy and average energy in Japan's charts, $r(8) = .07$, p (2-tailed) = .832.

In terms of connection with the global streaming market share, there was a statistically significant negative correlation between music streaming's global market share and average energy in the Global charts, $r(8) = -.96$, p (2-tailed) = .000 There was a statistically significant negative correlation between music streaming's global market share and average energy in Korea's charts, $r(8) = -.95$, p (2-tailed) = .000. There was no significant correlation between the music

streaming's global market share and average energy in Japan's charts, r(8) = -.11, p (2-tailed) = .750

Valence

Valence, which has to do with the emotional connotation of a song, is the third variable that represents an interpretation by Spotify. Once again, we see the trend of relative stability in the characteristics of the Japanese charts in contrast to the Korean and Global which again mirror each other in a downward trend.

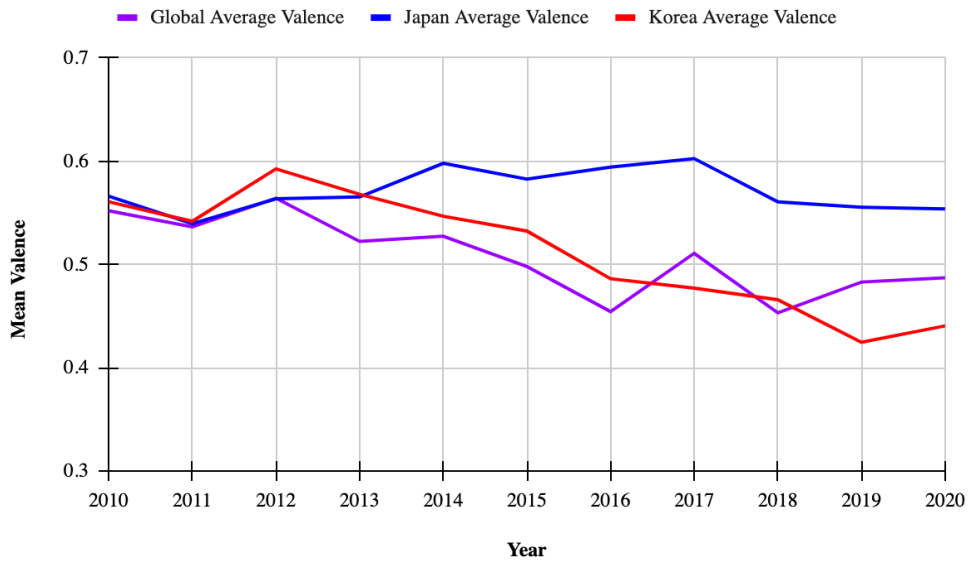

Figure 5. Average Valence by Year

Spearman's Rho rank correlation confirms what we can infer from the descriptive statistics, with Global/Korea sharing correlations when it was used to examine whether there was any statistically significant correlation between regional markets' valence levels, as well as valence and streaming market share growth.

Spearman's rank correlation showed there was a statistically significant positive correlation between average global chart valence and average valence in Korea's charts, r(8) = .82, p (2-tailed) = .002. There was no significant correlation between the average global chart valence and average valence in Japan's charts, r(8) = .05, p (2-tailed) = .894.

In terms of connection with the global streaming market share, there was a statistically significant negative correlation between music streaming's global market share and average valence in the Global charts, r(8) = -0.84, p (2-tailed) = .001. Spearman's rank correlation was computed to assess the relationship between music streaming's global market share and average valence in Korea's charts. There was a statistically significant negative correlation between music streaming's global market share and average valence in Korea's charts, r(8) = -.89, p (2-tailed) = .000. There was no significant correlation between music streaming's global market share and average valence in Japan's charts, r(8) = -.1, p (2-tailed) = .770

Mode

Mode refers to whether a song is in a major or minor key. In looking at this variable, three perspectives were explored. The first, is whether there were correlations between regions in the number of major/minor keys in the charts each year, normalized to compensate for variance in the total songs per year in the data. The second, is whether there is a correlation between the valence of a region and the number of major/minor key tracks since major/minor key has been shown to

impact the emotional connotation of a song. Thirdly, correlation was explored between streaming's market share and the percentage of major/minor tracks per year.

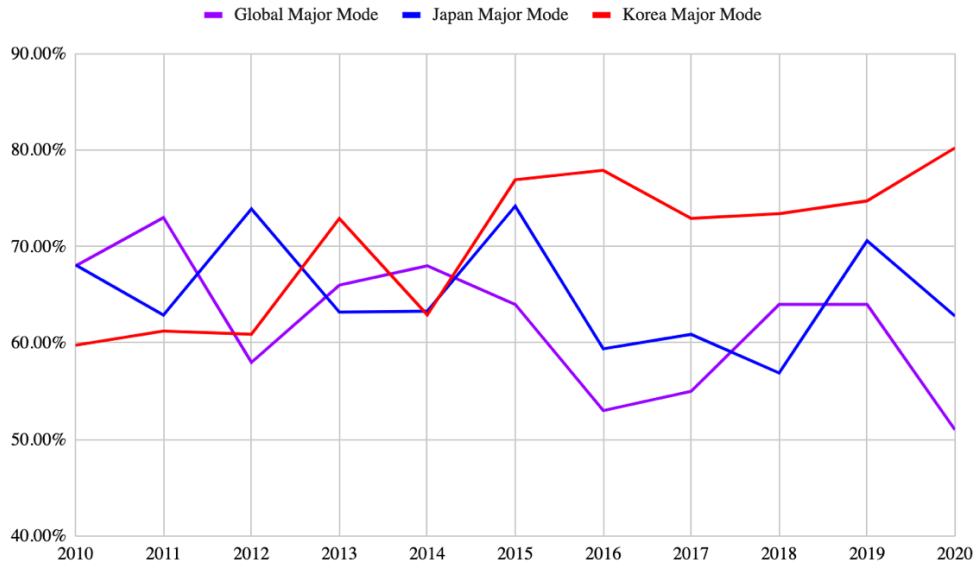

Figure 6. Percentage of Songs in Major Key by Year

The clearest trend that is noticeable is the significant surge in major key songs in the Korean charts, but there are few other features to point at this stage. Spearman's Rho was conducted to explore the three possible relationships previously mentioned and are reported below.

Spearman's rank correlation showed there was a statistically significant negative correlation between average global chart mode and average mode in Korea's charts, $r(8) = -.71$, p (2-tailed) $= .015$. There was no significant correlation between average global chart mode and average mode in Japan's charts, $r(8) = .19$, p (2-tailed) $= .574$.

There was no significant correlation between average valence in the Global charts and average mode in the Global charts, $r(8) = .50$, p (2-tailed) = .120. There was a statistically significant negative correlation between average valence in the Korean charts and average mode in the Korean charts, $r(8) = -.68$, p (2-tailed) = .021. There was no significant correlation between the average valence in the Japanese charts and average mode in the Japanese charts, $r(8) = -.16$, p (2-tailed) = .641.

In terms of connection with the global streaming market share, there was a statistically significant negative correlation between music streaming's global market share and average mode in the Global charts, $r(8) = -.68$, p (2-tailed) = .021. There was a statistically significant positive correlation between music streaming's global market share and average mode in Korea's charts, $r(8) = .81$, p (2-tailed) = .002. There was no significant correlation between the music streaming's global market share and average mode in Japan's charts, $r(8) = -.33$, p (2-tailed) = .320

Duration

Duration is the measure of the length of a track in milliseconds, which was then converted into minutes in order to present it in a more recognizable format. The average song duration in Japan's popular music is roughly 4.4 minutes, while Global and Korea's is around 3.8 minutes. None of these exhibit any statistically significant relationships with each other, but do demonstrate some significance when compared with the growth of music streaming's market share.

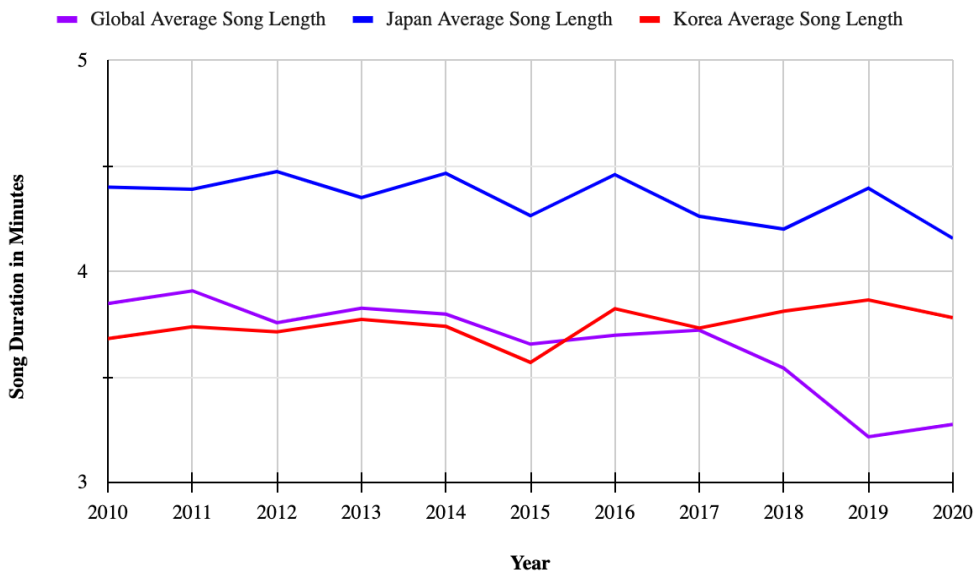

Figure 7. Average Duration of Songs (in minutes)

Spearman's rank correlation was computed to assess the relationship between average global chart duration and average duration in Korea's charts. There was no significant correlation between the two variables, r(8) = -.52, p (2-tailed) = .102. There was no significant correlation between the average global chart duration and average duration in Japan's charts, r(8) = .42, p (2-tailed) = .201.

In terms of connection with the global streaming market share, there was a statistically significant negative correlation between music streaming's global market share and average duration in the Global charts, r(8) = -.92, p (2-tailed) = .000. There was a statistically significant positive correlation between the music streaming's global market share and average duration in Korea's charts, r(8) = .64, p (2-tailed) = .035. There was no significant correlation between the music streaming's global market share and average duration in Japan's charts, r(8) = -.57, p (2-tailed) = .066

Loudness

Lastly, is loudness, which is a measure of loudness in decibels typically in the range of -60 to 0. This metric could be misleading for a number of reasons which will be discussed further in the next section, but will still be analyzed and reported here in an effort to be transparent and exhaustive in the reporting of data. Spearman's Rho was used to examine whether there was any statistically significant correlation between regional markets' loudness levels, as well as loudness and streaming's market share growth.

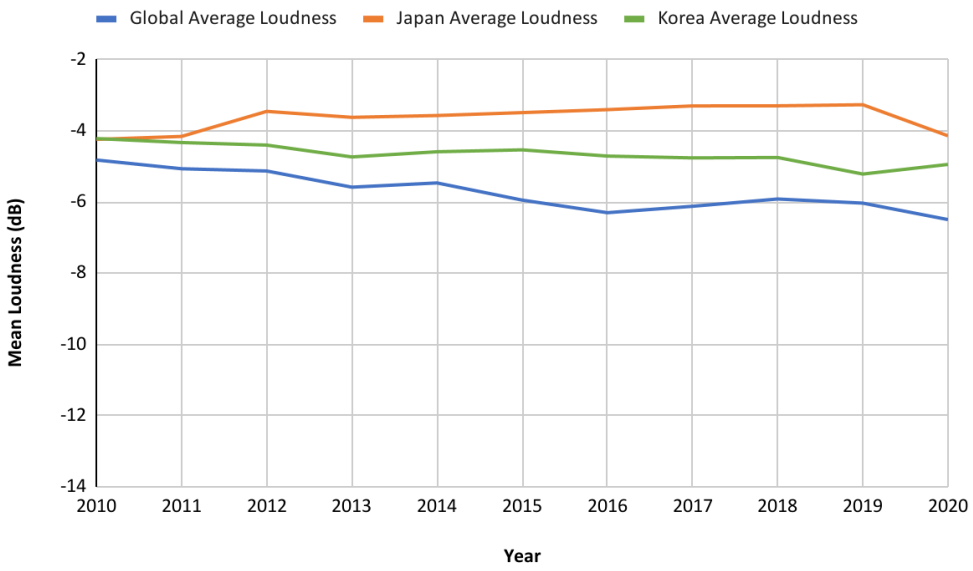

Figure 8. Average Loudness of Tracks

Spearman's rank correlation showed there was a statistically significant positive correlation between average global chart loudness and average loudness in Korea's charts, r(8) = .8, p (2-tailed) = .003. There was no significant correlation between average global chart loudness and average loudness in Japan's charts, r(8) = -.49, p (2-tailed) = .125.

In terms of connection with the global streaming market share, there was a statistically significant negative correlation between music streaming's global market share and average loudness in the Global charts, $r(8) = -.88$, p (2-tailed) = .000. There was a statistically significant negative correlation between music streaming's global market share and average loudness in Korea's charts, $r(8) = -.92$, p (2-tailed) = .000. There was a statistically significant positive correlation between music streaming's global market share and average loudness in Japan's charts, $r(8) = .62$, p (2-tailed) = .043

CHAPTER 5

DISCUSSION

While we have defined the variables that Spotify returns in the audio features process, before examining the data it is important to understand the weight each of the variables carry. In this case, all things are not to be considered equal in our understanding of the composition of regional popular music, with danceability, energy and valence being more significant for the scope of this research. It is difficult to use any single identifier to define a track, but Spotify's audio analysis capture's what many would call the "feel" of music and assigns it both a category and a numeric value. As such, this study is focusing on the variables that directly relate to the perceived feel of each region's popular music. Though not every variable that was reported offers such confidence, with there being caveats to our interpretations for both duration and loudness.

Danceability, Energy, and Valence.

Here, it is worth examining danceability, energy, and valence together, as I believe that these three variables are the most indicative of the perceived characteristics of popular music, as well as the most forward-facing aspects for the average listener. These three metrics are quantified expressions of some of the primary facets many would use in describing the sound of a song. Does the track make you move, or is it slow and vibey? Does it make you feel amped up, or relaxed? Does it make you feel happy or sad? Many of these characteristics are encompassed through the examination of the danceability, energy, or valence of a

track, which is why these three metrics are key in measuring the trends of music across regions.

Danceability focuses primarily on the regularity and intensity of a track's beat and tempo which Spotify argues are key components of how danceable a track feels. The data presents mixed results. We see significant negative correlation between global danceability and Korean danceability, and most notably in the past 5 years global danceability has grown while Korean has decreased. This relationship is equally demonstrated in the relationship with each region and the growth of streaming, with global increasing as streaming has grown and Korean decreasing as streaming has grown. Meanwhile, Japan has remained relatively unchanged and demonstrates no correlation with global danceability or streaming.

Energy, which can be thought of as how lively and energetic a track is, demonstrates a strong relationship between global and Korean energy levels, and they very nearly mirror each other year to year. Additionally, we see a negative correlation between both global and Korean energy levels and the growth of streaming. Meanwhile, Japan remains consistent and demonstrates none of these correlations. We see all three regions start out with similar energy levels before Global and Korean charts trend downwards, and Japan sees a short spike before a long period of relative stability.

Valence focuses on the perceived emotional connotation, though what factors contribute to the valence of a track are not clearly revealed by Spotify. In examining this metric, we see that the different regions once again start in nearly

the same place, and then global and Korean valence steadily decreases while Japan sees relatively minor variations. This is represented in the correlation analysis with Japan demonstrating no correlations with either global charts of the growth of streaming, while global and Korean charts both have significant negative correlation with each other and the growth of streaming market share.

In viewing these three metrics together, a pattern begins to emerge with Global and Korean charts exhibiting strong correlations between each other in energy levels and valence, as well as similar relationships in their movements and the growth of streaming market share. Korea has clearly set out to distribute its music on the global market and has gone as far as importing talent in the pursuit of that goal (Oh, 2013). This global focus is clearly represented in two of the three key characteristics examined here. Japan on the other hand has demonstrated a significant amount of insulation to the happenings in the global music industry, as exemplified in its lack of international artists charting in the region to the continued dominance of physical sales. The data represents these observations in that Japan shows no correlations with global musical characteristics or music streaming in any way. Not only does Japan not demonstrate correlations, but the data also shows a relative year to year consistency in the characteristics of the region's popular music, with minimal variations in each category.

Despite K-Pop having a well-known emphasis on choreography, it is interesting that danceability was decreasing while global danceability was on the rise, and it is the only variable of these three to demonstrate such divergence between global and Korean trends. It is reasonable that some characteristics will

diverge from global trends since the globalization of local music is observed to involve a fusion of sounds rather than complete adoption of the global. As such, what we see is that the data seems to support the use of musical characteristics in observing the overall globalization of a region's popular music, as the correlation between some of the characteristics appear to exhibit trends that seem influenced by the global trends of popular music beyond the possibilities of chance. Additionally, when viewed through the growth of streaming as the primary medium for listeners, we see that the majority of these variables are decreasing over time, slowly approaching the .5 range. The distribution of these specific variables is expected to have regular distributions (Koh, 2018), so a move towards .5 means that the mean of the Top 100 tracks is sitting almost dead center of what we would expect the overall distribution to be. To put it simply, this would indicate that the Top 100 charts in Global and Korea are moving towards a more even distribution of musical characteristics, showing greater diversity and variety within the composition of popular music.

Mode

Mode, which is an indicator of whether the track is major or minor, provides some interesting insights in light of current literature's perspective on modes' impact on a track's emotional connotation. Research has suggested that the choice of major or minor key can have a significant impact on whether a song is perceived as happy or sad (Hunter & Schellenberg, 2010), and as such one would expect a relationship between mode and valence. Similar to other musical

characteristics, Japan demonstrated no relationship to other regions or the growth of streaming, meanwhile Korea and global mode diverged from one another. Through the growth of streaming, we see that the global charts start to even out in a more uniform distribution between major and minor keys and exhibit a statistically significant negative correlation. This may indicate that in the same way streaming has influenced the diversity of listening habits, it may also be diversifying the creative choices of musicians on the global stage since the choice of mode influences the melodic progression and emotional undertone of a track**.** Additionally, we see that there is a negative correlation between global mode and a positive correlation between Korean mode when related with the growth of streaming, offering no clear pattern between global mode and regional trends.

When examining the relationship of valence and mode, we see no correlation between valence and the percentage of tracks in a major or minor key on the global charts and Japan, and a negative correlation demonstrated in the Korean charts. Despite the rise of major key tracks in Korean, we see the perceived valence of tracks decreasing, which indicates that mode may not be the dominant factor in the perceived emotion of a track. While global use of major keys and valence are both seen decreasing in this timeframe, the relationship was not significant, and demonstrated no connection to one another's values.

Loudness

Loudness, which focuses on the perceptual volume of a track, and is an average of the entire track's loudness levels. In this way, loudness is also a

representation of the full dynamic range of a track (range between a soft instrumental verse and a full energetic chorus), yet this still has limited uses for our understanding of a track's characteristics. The primary reasons for the lack of weight that can be attributed to loudness are twofold. Firstly, loudness is a standardized production value, and not typically an artistic choice. In fact, the loudness of a track has very little to do with any of the content contained within a track. Much like a speed limit on a road, producers have target loudness levels that they aim for when mastering a track for distribution. While this isn't necessarily an enforced rule, these standards are adopted by the majority of producers for reasons of end product quality and consistency. Secondly, there remains a lack of clarity about exactly what the loudness reading from Spotify is representative of. Spotify runs several processes on uploaded songs, including gain compensation (gain is essentially a form of volume) in order to even out loudness levels into a uniform -14 LUFS listening experience in accordance with international loudness guidelines (*Help - Loudness Normalization – Spotify for Artists*, n.d.). Additionally, Spotify introduces compression on uploaded tracks, though this is usually dynamic and set by the listener through selecting stream quality. What these lead to is overall uncertainty on what the loudness metric is representative of, as it is unclear as to when in the upload process the loudness rating is performed. Additionally, while it is described as "loudness in dB", it fails to explain the various dB readouts that are possible for it to return. While the industry standard is to measure tracks in LUFS, there are multiple different versions of LUFS readings (Russell, 2020). We can assume that if it is in LUFS, it

would be an integrated LUFS reading which accounts for the dynamics of the track as a whole as they report, but that still doesn't rule out the possibility that the loudness is being delivered in another format such as Root Mean Squared (RMS), which is a loudness measure still used by some. Even if we did have an understanding of the readouts produced through Spotify's API, it should still be understood that this as an industry standard production value, which is why each region produces such similar values and see relatively little to no change year over year in these values, therefore adding little to the conversation of this research.

Duration

Duration also provides interesting insights, though in this case it is due to the influence that previous technologies have made on the music industry. For years, artists have sought the magic formula for creating a radio hit, and a big factor of that is in length. The commonly accepted target for crafting a single is 3.5 minutes, but the bigger question is why, and whether there is something that we can infer from this in examining the data that was gathered. Technology was a major factor in settling into this magic 3.5-minute sweet spot, and this can be traced back to when the radio was the primary medium for audiences. In the 60's and 70's, singles were sold on 45 RPM (rotations per minute) vinyl records, and radio stations used these 45 RPM records as well. There was a limiting factor to the 45, as well as its predecessor, the 78, and that is song length. In this time period, the disks used for singles could only contain a song of around 3-4 minutes

in length (McKinney, 2014), and we can see the influence of that today in how the industry continues to develop what is perceived as the ideal single. This influence comes across as an unwritten rule of radio rather than a fixed target, as if a song is popular enough it will still get radio play despite its length being longer, though singles released for the purpose of radio play will almost always still be in the 3–4-minute range in many regions.

Understanding this history allows us to frame our interpretation of the data we have gathered. Immediately, it is apparent that the Japanese music market has a different ideal for popular tracks than both global and Korea. Consistently, Japan tends to favor songs that are roughly 4.5 minutes in length, while Global and Korea squarely fall into the typically accepted ideal of 3.5 minutes. This disparity may possibly be linked to the role radio plays in the respective markets. Radio remains an important piece of the music distribution process on the global scene, and Korea has made a clear goal of breaching the global market with its own music. Ulrich Heinze (2011) suggests, however, that radio plays a significantly less important role in the average consumer's listening habits in Japan compared to other major music markets. It is likely that by having a lesser role in the distribution flows of popular music, even prior to the growth of music streaming, the average length for a single wasn’t compelled to conform to the radio model that remains popular in other regions.

When viewed through the lens of streaming growth, we see a negative correlation in streaming growth and global track duration, and a positive correlation between Korean track duration. Korea, while demonstrating a

correlation, actually remains fairly consistent in the 11-year data period. On the other hand, the global correlation is significantly stronger, with track duration shortening significantly at the same time that music streaming started to dominate the market share. Calling back to the earlier observations of digital chart volatility by Jovanovska et al. (2020), what could be represented here is a reaction to the challenges artists face in a saturated market. Having difficulty remaining in a listener's library since the growth of streaming may be incentivizing artists and producers to shorten track length in an effort to stay in a listener's rotation.

CHAPTER 6

CONCLUSION

Overall, the data suggests that the growth streaming demonstrates correlates with changes in particular characteristics of popular music as a whole, and globalization is observable in the musical characteristics of regional popular music. Streaming fosters unprecedented accessibility for listeners to engage with more artists from more regions than before, and this change is likely influencing the characteristics of popular music. This is not represented universally in musical characteristics, but several key components of what entails the "feel" of a track show significant negative correlations to the growth of streaming. This suggests that streaming may be encouraging greater diversity in musical characteristics within popular music, and that regional markets are being influenced by these trends.

Additionally, the research supports the earlier idea that globalization manifests itself through the resurgence of local culture and the development of hybrid styles that reflect global trends and local culture, and this is observable in the musical characteristics of local artists. When contrasting the globally facing Korean music market with the domestically focused Japanese market, there are clear relationships between the Korean market and the Global market observable through the characteristics in the music. Each region's data set consisted of domestic and regional artists, yet the tracks in Korea still demonstrated similar patterns to the global market which supports the previous observations that globalization presents itself in the sounds of local artists instead of a complete

takeover by global culture. The contrasting Japanese market shows its insulation to global trends through its lack of correlations and consistency in musical characteristics. This potentially provides an avenue for researchers to observe the globalization of regional markets in a way other than chart diversity, and allows the quantification of global influence in local sounds. Previously, there were few ways presented to measure the effect of globalization on local artists, but this method offers a new approach that can account for this interaction of global and local culture. This cannot discount the natural evolution of regional popular music, but the relationships observed appear to be beyond mere chance.

While this approach is beneficial to future research, it is far from exhausting and fails to capture the other ways in which regional music can incorporate global influence into their music. A key feature of a song that this approach is unable to measure is the use of language. Initial observations of the Korean and Japanese markets indicate an evolving trend in song creation, where many tracks incorporate multiple languages into them. Of these languages, the most prevalent is the incorporation of English, which would position a song for better marketability to global audiences (Achterberg et al., 2011; Verboord & Brandellero, 2018) and increases the likelihood that algorithms will place it in globally marketed playlists. Future research could target the use of language in regional markets to further understand how regions are being globalized in ways beyond the influx of foreign artists or the measure of musical attributes.

Examining globalization remains an important task for researchers, as local cultures are a key form of identity and representation within a community. In

uncovering a new way to identify the potential local impact of global influences on music culture, this study allows researchers to identify what ways domestically produced popular music are following global trends. If a region is in fact following global trends, it is fair to ask if the music continues to be representative of local identity and ideals. Streaming provides the means for greater globalization in regional popular music, and if regional artists begin to represent global consciousness instead of local, how does this impact the identity of a region and is this cultural artifact accurately representing the community it emerged from? These are all questions that stem from the impact of globalization, and questions that the results of this research move us closer to being able to quantify and answer.

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APPENDIX A

DATA TABLES

Table 2

Spotify Danceability Data Set

Year	Mean of Danceability	Standard Deviation of Danceability
	GLOBAL	
2010	0.6249	0.1363070287
2011	0.62902	0.1117218751
2012	0.647959596	0.1082526259
2013	0.63555	0.1175633399
2014	0.64684	0.1352962123
2015	0.66463	0.1504920989
2016	0.66161	0.12361188
2017	0.71535	0.1261179002
2018	0.71857	0.1401969938
2019	0.71629	0.1333638825
2020	0.6962	0.1252473916
	Japan	
2010	0.5580957447	0.1213758111
2011	0.5587142857	0.1182020063
2012	0.5485797101	0.1331996959
2013	0.5551911765	0.11248738
2014	0.5419333333	0.1075900674
2015	0.5513333333	0.1153016556
2016	0.55590625	0.1037958495
2017	0.537796875	0.1074458416
2018	0.5520277778	0.109257542
2019	0.5430735294	0.1142540134
2020	0.5600697674	0.1138345332
	Korea	
2010	0.6547586207	0.1375219192
2011	0.6282125	0.1472135015
2012	0.6483103448	0.1310360602
2013	0.63471875	0.1385125267
2014	0.6142022472	0.1395249391
2015	0.6451868132	0.1363663295
2016	0.5899789474	0.1396590056
2017	0.5979494949	0.1389893091
2018	0.5984893617	0.1532417266
2019	0.5631428571	0.1392564039
2020	0.5818023256	0.1417113736

Table 3

Spotify Energy Data Set

Year	Mean of Energy	Standard Deviation of Energy
	Global	
2010	0.75235	0.1301547932
2011	0.75343	0.1298246101
2012	0.7367878788	0.1550522804
2013	0.70689	0.1593659086
2014	0.69373	0.1586048934
2015	0.656003	0.1603478192
2016	0.633915	0.1551087116
2017	0.63035	0.1452737837
2018	0.6372	0.1404894043
2019	0.61499	0.1425888697
2020	0.6048	0.1465175551
	Japan	
2010	0.7967446809	0.1615767693
2011	0.8295714286	0.1973652959
2012	0.9002463768	0.09141621136
2013	0.8846764706	0.1156567801
2014	0.8817333333	0.1130322988
2015	0.8787121212	0.1058845184
2016	0.879109375	0.1355392659
2017	0.882796875	0.1176465219
2018	0.8783194444	0.1260769747
2019	0.8635	0.115052681
2020	0.8095	0.1574802135
	Korea	
2010	0.7746436782	0.1524703537
2011	0.729025	0.1908296991
2012	0.7476436782	0.1839622672
2013	0.6865208333	0.1851863914
2014	0.6980786517	0.2011779642
2015	0.7062120879	0.2223143269
2016	0.6524526316	0.2053886699
2017	0.6440909091	0.20459707
2018	0.6401489362	0.2157882254
2019	0.5826703297	0.1877966427
2020	0.6253488372	0.1891248431

Table 4

Spotify Valence Data Set

Year	Mean of Valence	Standard Deviation of Valence
	Global	
2010	0.55199	0.2199054202
2011	0.536453	0.2152448577
2012	0.5641515152	0.2108766621
2013	0.522333	0.2148226518
2014	0.527296	0.2395544496
2015	0.49804	0.2245969193
2016	0.454384	0.1953600513
2017	0.510844	0.2042888692
2018	0.453144	0.202650961
2019	0.482967	0.2077297871
2020	0.487007	0.2016875132
	Japan	
2010	0.5661808511	0.2171068298
2011	0.53938	0.2159947481
2012	0.5636086957	0.1999978836
2013	0.5653220588	0.2186743902
2014	0.598	0.1836032938
2015	0.5827272727	0.1797995076
2016	0.59421875	0.2015413203
2017	0.602484375	0.15972516
2018	0.5605555556	0.2096510104
2019	0.5553235294	0.1670010672
2020	0.5537023256	0.1823702291
	Korea	
2010	0.5606781609	0.2160449186
2011	0.5417625	0.2392724332
2012	0.5925632184	0.2336995537
2013	0.5679322917	0.2513517311
2014	0.55	0.258878901
2015	0.53	0.2435112536
2016	0.48614	0.2319348503
2017	0.477	0.2034978815
2018	0.4658702128	0.2248292173
2019	0.4245604396	0.2032096459
2020	0.4404581395	0.2194403767

Table 5

Spotify Mode Data Set

Year	Minor Mode Percentage	Major Mode Percentage
	Global	
2010	32.00%	68.00%
2011	27.00%	73.00%
2012	41.00%	58.00%
2013	34.00%	66.00%
2014	32.00%	68.00%
2015	36.00%	64.00%
2016	47.00%	53.00%
2017	45.00%	55.00%
2018	36.00%	64.00%
2019	36.00%	64.00%
2020	49.00%	51.00%
	Japan	
2010	31.90%	68.10%
2011	37.10%	62.90%
2012	26.10%	73.90%
2013	36.80%	63.20%
2014	36.70%	63.30%
2015	25.80%	74.20%
2016	40.60%	59.40%
2017	39.10%	60.90%
2018	43.10%	56.90%
2019	29.40%	70.60%
2020	37.20%	62.80%
	Korea	
2010	40.23%	59.77%
2011	38.75%	61.25%
2012	39.08%	60.92%
2013	27.08%	72.92%
2014	37.08%	62.92%
2015	23.08%	76.92%
2016	22.11%	77.89%
2017	27.08%	72.92%
2018	26.60%	73.40%
2019	25.27%	74.73%
2020	19.77%	80.23%

Table 6

Spotify Duration Data Set

Year	Mean of Duration (in milliseconds)	Standard Deviation of Duration (in milliseconds)
	Global	
2010	230891.01	31787.11989
2011	234510.76	30122.17903
2012	225426.9798	26407.66831
2013	229587.18	36612.21377
2014	227869.71	33528.72717
2015	219337.95	30900.98067
2016	221895.61	27012.00292
2017	223301.64	36272.2697
2018	212496.48	41724.67795
2019	192991.73	34444.84764
2020	196513.32	26614.57717
	Japan	
2010	264000.1277	55448.24727
2011	263441.5143	63248.55365
2012	268456.5652	46174.96522
2013	261004.3824	39021.07089
2014	267936.5	40114.02188
2015	255863.3333	34579.94696
2016	267552.875	41182.12783
2017	255705.6406	37297.4726
2018	252075.5694	36121.59734
2019	263727.6471	65064.26964
2020	249434.8023	50636.01532
	Korea	
2010	220929.8851	27031.7048
2011	224251.15	25188.2432
2012	222810.7586	22231.33687
2013	226367.1458	29747.91858
2014	224384.0449	27054.43485
2015	214138.2967	26666.05421
2016	229409.3579	31170.10682
2017	223935.3838	35130.17195
2018	228717.3617	35476.74762
2019	231918.044	29191.54795
2020	226855.7791	33461.53221

Table 7

Spotify Loudness Data Set

Year	Mean of Loudness (dB)	Standard Deviation of Loudness (dB)
	Global	
2010	-4.81758	1.619849314
2011	-5.06304	1.522409732
2012	-5.126282828	1.877425441
2013	-5.58054	1.753869318
2014	-5.46177	1.709287765
2015	-5.94408	2.099711196
2016	-6.29791	2.132228365
2017	-6.1178	1.990892734
2018	-5.91313	1.706811225
2019	-6.0291	2.292769427
2020	-6.49141	2.20125551
	Japan	
2010	-4.23756383	1.984529166
2011	-4.1549	2.283486129
2012	-3.450942029	1.2814495
2013	-3.618867647	1.151924748
2014	-3.56735	1.459246298
2015	-3.485681818	1.392450934
2016	-3.402671875	1.351558478
2017	-3.29734375	1.306299368
2018	-3.294791667	1.335585296
2019	-3.264264706	1.471708649
2020	-4.137081395	2.005466654
	Korea	
2010	-4.214827586	1.633804415
2011	-4.32665	1.884781323
2012	-4.398390805	1.995842804
2013	-4.731145833	1.840244841
2014	-4.59	2.216145595
2015	-4.53	2.481623636
2016	-4.706894737	2.24545338
2017	-4.75840404	2.285212837
2018	-4.746744681	2.016152297
2019	-5.212087912	1.811077903
2020	-4.941593023	1.804238176

APPENDIX B

PYTHON CODE FOR SPOTIFY AUDIO FEATURES

The Python code that was used to gather the data can be found at https://github.com/kdhaas/Spotify-Track-Features-by-Playlist.