Rockonomics revisited: The rise of music streaming services and the effect on the concert industry

Adam Fer & Barbara Baarsma[1]

Abstract
According to Krueger (2005) the main reason for concert ticket prices for popular music to show a sharp increase between 1996 and 2003 is that artists felt less constrained from increasing prices due to the erosion of the complementary relationship with album sales. This paper continues his analysis in a more current context by focusing on how the rise of music streaming services has influenced concert ticket prices and revenues, while also providing a brief analysis on the effects of the economic crisis.

Keywords: Music industry, concerts, streaming services, digitalisation

1 Introduction

The music industry has experienced dramatic changes in the past two decades. The digitalization of music along with the increasing prevalence of Internet access has created new challenges and opportunities for record companies, concert promoters, and artists. It does not come as a surprise that these shifts have impacted the earnings model in the music industry in terms of album and concert ticket sales (Caves 2003; Gopal et al. 2006). According to data from the Recording Industry Association of America (RIAA) the turnover from recorded music sales fell by 43 percent between 2004 and 2013. Despite the enormous growth of almost 2,300 percent in the same period, digital shipments have not been able to make up for this decline.

[1] **Barbara Baarsma** is Professor of Applied Economics at the Faculty of Economics and Business at the University of Amsterdam. She also works at the Rabobank, and is a crown member of the Social and Economic Council of the Netherlands (SER) (B.E.Baarsma@uva.nl). **Adam Fer** completed his academic education at the University of Amsterdam. During his stay at this university he co-wrote this paper. He now works in the media industry (adamdfer@gmail.com).

1.1 Krueger (2005)

In his 2005 paper, 'The Economics of Real Superstars: The Market for Rock Concerts in the Material World', Alan Krueger analysed the trend in concert ticket prices for popular music, which showed a sharp increase beginning in the late nineties. Specifically, he found that ticket prices on average increased 4.9 percent per annum between 1981-1996, whereas the annual growth was 11.1 percent between 1996 and 2003. Furthermore, price and revenue dispersion between the highest and lowest earning artists increased remarkably. He explained the trend in ticket prices by the decreasing complementarity between concerts and album sales. He proposed four main hypotheses to explain this phenomenon: the 'superstar' effect, increasing production cost, the dominance of Clear Channel, and the Bowie theory.

Beginning with the superstar effect originally proposed by Rosen (1981), Krueger acknowledged the music industry is certainly characterized by Rosen's model in that the top 1 percent of artists earns the majority of concert revenues. In line with Rosen's theory, the presence of the Internet increased the market size for artists, which in turn should increase the returns for the top 1 percent or stars. In order to test this empirically, Krueger developed a novel measure of star quality: the amount of print (in millimetres) devoted to each artist in *the Rolling Stone Encyclopaedia of Rock & Roll*, which reflected the implicit value the editors attached to each artist. His results showed that star quality does explain the higher prices more popular artists garnered in the late 1980s and early 1990s, but it cannot explain the jump in prices in the late 1990s and early 2000s.

Another explanation for the trend in concert ticket prices is that the costs of production are increasing, thereby outpacing productivity growth. Certainly in some ways the costs of concerts may have gone up, but other recent developments in audio equipment arguably may have brought costs down. It is difficult to attribute such a stark increase in price to these supposed cost increases without hard data, which is difficult to obtain.

The monopolistic power of Clear Channel, a major multimedia conglomerate in the United States, is also put forward as an explanation. In 2000, Clear Channel acquired SFX Entertainment, bringing it fully into the concert promotion business. Coupled with its ownership of numerous TV and radio stations, it seemed well positioned to exercise its dominance in the market. Krueger admitted that he expected this to be the best explanation, but the evidence suggested otherwise. The refutation of the Clear Channel argument leads Krueger to his final hypothesis: the *Bowie theory*.

1.2 The Bowie theory

In the past, concert ticket sales often translated into greater album sales. Thus, there was a complementary relationship between the two goods. This gave artists an incentive to price their concerts well below the market clearing level. The introduction of free access to music via file sharing networks has eliminated, or at least severely degraded, the link between album sales and concerts, which has resulted in concerts becoming more like single price monopoly products. Furthermore, only the top artists tend to receive royalties from album sales anyway (Caves 2003), so this could also explain the increased dispersion of price. Krueger (2005) assessed this with a formal model of two complementary goods. He argued that the coefficient that characterizes the positive relationship between concert ticket sales and album sales has declined, so promoters and artists now feel less constrained when setting their concert prices.

Artist David Bowie anticipated the erosion of this complementary relationship, *"Music itself is going to become like running water or electricity. You'd [artists] better be prepared for doing a lot of touring because that's really the only unique situation that's going to be left."* (quoted from Pareles 2002). Krueger thus refers to this as the Bowie theory.

Some empirical support exists for his hypothesis. For example, jazz music is much less likely to be illegally downloaded than pop and rock (Oberholzer-Gee & Strumpf 2007). Between 1996 and 2003, the price of

jazz concerts increased by only 20 percent, while the price for pop and rock concerts increased by 99 percent. Johansson & Larsson (2010) show that for the music industry in Sweden, total revenue has stayed around the same level, but revenue shares have shifted towards live performances and away from recorded music. This suggests further that the Bowie theory may be correct. Finally, a study by Montoro-Pons & Cuadrado-Garcia (2011) finds no significant correlation between higher concert attendance and subsequent purchase of pre-recorded music. The sample is limited to Spain, but it provides support for the Bowie theory.

This theory is, however, sensitive to whether file sharing does indeed decrease album sales to a significant extent. While common sense seems to dictate that this would surely be the case, there is in fact mixed evidence on the subject. Gopal et al. (2006) emphasize the 'sampling effect' of file sharing. Consumers are able to sample music for free using P2P networks and later choose to purchase the albums they really like because of the extra benefits of purchasing (higher quality, album art, support the artist). Gayer & Shy (2006) and Peitz & Waelbroeck (2006) find similar results. Andersen et al. (2007) and Van Eijk et al. (2010) find survey evidence that further supports the theory that both consumers and producers profit from digitalization, while Blackburn (2004) and Bounie et al. (2005) find empirical evidence that may also support the theory, though not unilaterally. Liebowitz (2006) counters this logic, stating that while there are some 'explorers' who use P2P networks to find music that they later purchase, the majority of P2P users is satisfied by the music downloaded from P2P networks. He further goes on to show this empirically, finding a negative relationship between album sales and file sharing. Zentner (2006) finds similar empirical results using students in French graduate schools as a sample.

Although the relation between file sharing and album sales has been studied, the relationship between file sharing and concert tickets has been studied to a much lesser extent. Based on a theoretical model Gayer & Shy (2006) predict that massive anti-piracy campaigns that decrease free downloading will also make the artist *"significantly less popular thereby reducing the demand for the artist's live performances"*.

Dewenter et al. (2012) find a sampling effect whereby file sharing can increase demand for concerts. They differentiate between music listeners who receive utility from listening to recorded music and music lovers who receive utility from concerts as well. The sampling effect is larger when more music listeners turn into lovers due to file sharing.

1.3 From file sharing to music streaming services

Krueger (2005) concludes that the Bowie theory, the erosion of the complementary relationship between album sales and concerts due to digital piracy, is the most plausible explanation for the trend in concert ticket prices between 1996 and 2003. This paper continues this analysis in a more current context by focusing on how the rise of music streaming services has influenced concert ticket prices and revenues, while also providing a brief analysis on the effects of the economic crisis. Music streaming services provide access to music instead of ownership of it and are a substitute for pirated as well as legal music. It has won more ground the last few years. According to US market research company NPD Group, illegal music file sharing peaked in 2005 and has declined afterwards. In 2005, 20 percent of Internet users aged 13 and older used P2P services to download music; however, in 2011 that number fell to 11 percent. According to NPD, 4 in 10 Internet users who had illegally downloaded music via P2P services in 2011 reported that they had stopped or downloaded less music from P2P networks. The primary reason for this reduced file sharing activity was – according to NPD – an increased use of free, legal music streaming services.

1.4 A précis of the plot: main questions and hypotheses

The growing prominence of these services, beginning mainly after the period of focus in Krueger (2005), sparks a renewed interest in the music industry and the subsequent effects on the concert industry. This paper starts with the observation that the trend in ticket prices and revenues for popular concerts in the US after 2004 breaks from the pattern seen in Krueger (2005). After describing the data in section 2, in section 3, we show that the growth rate of both ticket prices and revenues has signifi-

cantly slowed down after 2005. In the remainder of the paper we try to explain the causes of this trend break in prices and revenues through an analysis of the artist and promoters' response to the economic crisis. In section 4 we hypothesize that the crisis had a substantial downward effect on ticket prices and revenues. We find that the crisis has indeed softened annual increase in prices. Additionally, we focus on changes in music listening, most notably through music streaming services. We describe the business model and how these services have increased the variety of services and ease with which consumers can listen to music (section 5). In section 6 we show that the revenues from concerts have become more evenly distributed among popular and less popular artists. We explain the downward trend in equality by the long tail distribution theory.

Moreover, we hypothesize that the more even distribution of revenues indicates that music streaming services have made it easier for less popular and new artists to gain popularity and to acquire a larger group of people who willing to buy a concert ticket. In the terminology used by Dewenter et al. (2012), music-streaming services enable less popular and new artists to turn a larger group of music listeners into music lovers. In section 7 we test how the use of music streaming services – in terms of number of weekly listens – affect prices, revenues and number of concerts. The result is that the large-scale rise of music streaming services positively affects both concert ticket prices, annual gross revenues as well as the number of shows. So, artists who have a lot of listeners are able to ask higher prices for their concerts and give more shows. Although the average revenue per show decreases as the number of shows increases, annual revenues still increase with the number of weekly listeners. We find that these relationships are stronger for less popular artists. This suggests that music streaming does indeed slow the growth of 'superstars' and distribute revenues more evenly. Because it is mainly the most popular artists who are responsible for the fast growth in concert prices, this might also explain how music-streaming services contribute to tempering this growth.

Krueger placed his study in the subfield of the economics of rock & roll, and termed this field 'rockonomics'. Although our paper has a more limited scope, we revise part of his analysis by looking into the effects of the increasing use of music streaming services. Krueger (2005: 27) concluded that: *"Even if Bowie theory is premature, it is likely that downloading of music will put upward pressure on concert prices and revenue in the near future."* First, we show that his prediction has not come true because the growth of both prices and revenues has slowed down. Moreover, we show that the growth of concert prices and revenues has become more even whereas Krueger finds that concert revenues became markedly more skewed in 1980s and 1990s. Thirdly, whereas Krueger emphasizes the declining complementary between record sales and concert tickets, we look into the complementary between the use of music streaming services and concert tickets. As far as we are aware, this paper is the first to combine data on the concert industry, recorded music listening behaviour, and macroeconomic variables.

2 Data

Our data on concert ticket prices and revenues comes from *Pollstar*, a trade magazine for the concert touring industry. The magazine has collected data on venue size, concert revenue, ticket sales and prices since it was founded in 1981. Unlike Krueger (2005), we do not have unrestricted access to the Pollstar Box-office Report database. We do, however, have data for the top 200 tours each year in North America from 2004 to 2013 (taken from the Pollstar Year End Business Analysis for 2004 to 2013). Other entertainment acts, such as comedians, traveling Broadway shows, and benefit concerts, are removed from the dataset. Of the top 200 tours, there remain on average 173 music acts, with the total across all ten years coming to 1,772.

For all top 200 tours, Pollstar provides data on total gross revenue, average ticket price, average tickets sold per show, and average gross revenue per show. Added information is provided for the top 100 tours, such as total tickets sold and number of shows. In addition to the top

200 tours, we employ data on the top 200 individual concert grosses in North America per annum. These reports include total gross revenue, tickets sold, and minimum and maximum ticket prices. The Pollstar Yearly Business Analysis provides the total concert revenue for North America.

In order to collect an unbiased, representative sample of listening behaviour using music streaming services we also use data from music data analytics company, *MusicMetric*, which collects data on number of plays per artist per week on *SoundCloud*, *YouTube*, *Last.fm*, and *Vevo*. This type of data collection is relatively recent, so the sample had to be restricted to 2011 to 2013 in order for the data reporting to be consistent. We selected artists who appear in our concert sample in the years 2011, 2012 and 2013. The resulting data set contains the number of plays per week for 242 artists for a total of 21,780 individual observations. The aggregation from multiple music streaming sites leads to lower potential for demographic bias. In section 7 we combine the data from Pollstar and MusicMetric in one dataset for 2011 to 2013. This combined dataset contains 32 artists for a total of 96 individual observations.

Though the MusicMetric dataset is quite large, it did not cover the same period as the concert data. Still, the amount of artists covered on a weekly basis provides an enormous amount of listening data. Moreover, had the dataset extended back a few more years, one would encounter numerous issues. Firstly the catalogue of songs and artists available on these sites increased over time, so any conclusion regarding diversity of popularity could be biased by the limitations imposed on the early users. Secondly, the results could be biased in earlier years by the number of early-adopters using the services as opposed to regular users. It could be argued that early-adopters are also more willing to try new types of music, so the results could be skewed. Thus, the relative short time period of our MusicMetric dataset is in a way stronger because it was collected from sites that have been popular among all demographics for at least a few years before the sample period. Furthermore, all the artists in the sample were sufficiently established and available on these sites before

the sample period, so there is little risk of 'rising star' bias or late inclusion into the catalogue.

3 Level of concert ticket prices and concert revenues

3.1. Prices

After 2004, there was a tempering of the stark trend exhibited between 1996 and 2003. The average nominal ticket price continued to rise, climbing from $45.02 in 2004 to $62.96 in 2013. While still outpacing a yearly CPI-U inflation rate of 2.4 percent, the 3.8 percent annual increase artists is significantly weaker compared to the 11.11 percent increase per annum between 1996 and 2003 that Krueger found. We conducted a standard t-test to prove that the trend in our sample is statistically different from the trend between 1996 and 2003. We found the difference to be significant at the 5 percent significance level for nominal prices, significant at 10 percent level for real prices. Figure 1 presents the average ticket price for the top 100 acts (including non-musical acts) for both Krueger and our period, i.e., 1996-2013. Especially after 2006 the growth of the prices for the top 100 acts decreases.

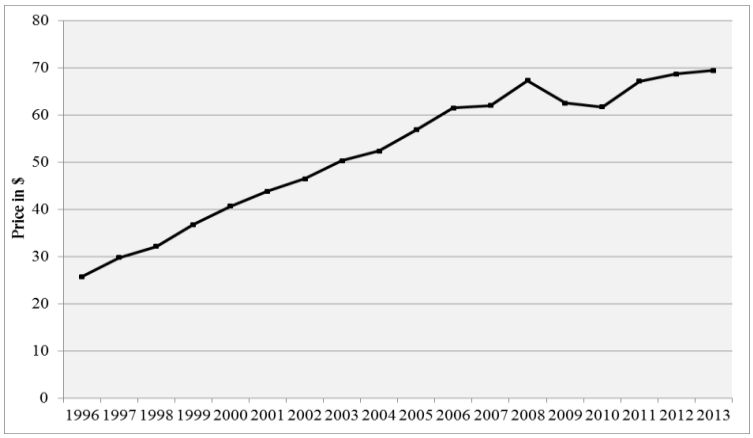

Figure 1: Nominal average price per ticket for top 100 acts, 1996-2013 (Source: Pollstar)

In order to provide a more robust measure of ticket price change in our concert sample, we expressed prices using the Laspeyres price index. We created a consistent basket by using rank. For each year, we ranked artists based on their annual gross revenue, then used rank as an 'item' in our basket. For example, to calculate the 2005 Laspeyres price index, we computed ($Rank_1Q_{2004}$ x $Rank_1.P_{2005}$ + $Rank_2.Q_{2004}$ + $Rank_2.P_{2005}$…/ $Rank_1Q_{2004}$ x $Rank_1.P_{2004}$ + $Rank_2.Q_{2004}$ + $Rank_2.P_{2004}$…). Table 1 gives the resulting adjusted Laspeyres index numbers and indicates that growth, although varying strongly per year has slowed down. A significance test for the overall trend in ticket price is significant at the 95 percent level.

Year	Index	Change in percent
2004	100.00	
2005	99.66	-0..34%
2006	110.71	11.09%
2007	113.40	2.43%
2008	131.79	16.22%
2009	120.27	-8.74%
2010	117.81	-2.05%
2011	125.67	6.67%
2012	129.73	3.23%
2013	129.72	-0.01%

Table 1: Adjusted Laspeyres index number, 2004-2013. (Source: Pollstar).

We also assess the differences in ticket price trends between the top 5 percent of earners (of the top 200) and the bottom 95 percent (figure 2). Because of the removal of non-music acts, the top 5 percent on average are the top 8 earners in each year. The nominal average tick-

et price for the top 5 percent was $85.64 in 2004 and rose to $113.56 by 2013, a gain of 32.6 percent. The average ticket price for the bottom 95 percent went from $43.07 to $60.57, which is a 40.5 percent increase. The average ticket price for the bottom 95 percent continued to be around half of the average of the top 5 percent.

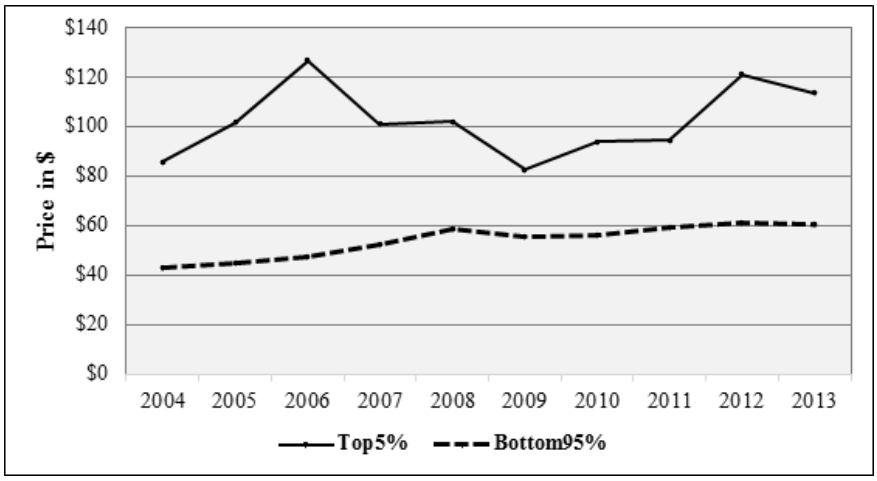

Figure 2: Average price per ticket: Superstars versus the rest (2004-13; N=1,726) (Source: Pollstar).

3.2 Number of shows and revenues

Despite the increasing ticket prices, fans continued to spend more to attend live concerts. The average amount of tickets sold per show went from 6,832 to 9,540, an increase of 39.6 percent. With higher ticket prices and higher average tickets sold, average revenue per show grew remarkably. In 2004, it was $368,054, but by 2013, it had nearly doubled to $662,894. There was a 7.5 percent annual increase in average revenue per show, but the growth of average gross revenue per year was only 4.4 percent. In general, the trends in prices, ticket sales, and average revenues follows the trend between 1996 and 2003 but are mostly less dramatic. Artists gave fewer shows with more attendees per show.

The ticket price also increased, which led to greater revenue per show. On a yearly basis, average gross revenue rose, but with fewer tickets sold.

Taking the top 5 versus the rest of the top 200, we checked whether these developments differ between these groups. We merely found two differences that are significant. We found a significant increasing trend in average tickets sold per show for the 'rest'. Also, there is a strong, significant downward trend in number of shows for the top 5 artists.

The decrease in the total number of tickets sold, along with the increase in total concert revenue, demonstrates a more inelastic demand for concerts overall. Accompanying such a trend is of course a rise in the average ticket price. Linking the trend in concert ticket prices and revenues to the prominence of music streaming services essentially requires explaining how the concert trends could be caused by a wider distribution of popularity for artists. This is done in section 7. First, section 4 looks into the effect of the crisis.

4 The effect of the economic crisis

The negative shock to consumer income presumably should decrease expenditures on entertainment goods, such as concerts. The global financial crisis appears to have impacted the concert industry. Figure 3 presents the average nominal prices from 2004 to 2013. It clearly shows the effects of the crisis, i.e., the setback after 2008.

According to the 2009 Business Analysis Report by Pollstar, artists and promoters accurately anticipated the climate they would be touring in as they set their prices and schedules for 2009. With high unemployment and a generally negative economic outlook, artists chose to decrease ticket prices and increase the number of shows on their tours to account for lower revenue per show. Effectively, they increased supply and lowered prices in response to a lower, more elastic demand. This proved to be an effective strategy. Despite the tumbling economy, the concert industry had record-setting revenue of $4.8 billion. The average ticket price for the top 5 percent (of the top 200) was $88.81, the lowest

it had been since 2005. These results show a rational response by the concert industry to their expectations of consumer demand in a depressed economic climate. Consumers still want to be entertained during times of crisis, but clearly supply must increase and prices must decrease to respond to a lower, more elastic demand.

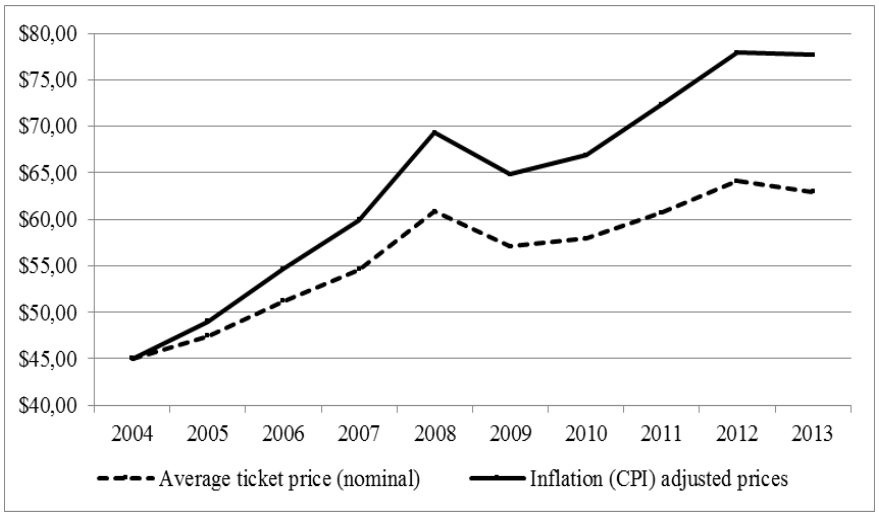

Figure 3: Average nominal price per ticket for top 200 (2004-2013; N=1,734) (Source: Pollstar; BEA).

Interestingly, the lessons learned from 2009 did not carry over into 2010. Total revenue fell for the first time since 1995 to $4.25 billion. Artists expected the economy to improve in 2010 (Pollstar 2011), so they chose to raise ticket prices (though on average the increase was relatively small). Demand remained relatively elastic, so this strategy did not appear to work. The results from 2010 show that although disposable income increased, artists and promoters overestimated increasing consumer optimism and consequently inaccurately predicted the elasticity of demand for the 2010-touring season. In general, the analysis shows that the concert industry responded rationally to the economic crisis, but their rational response is based on expectations of consumer demand in the near future, which turned out to be miscalculated in 2010.

It is also helpful to isolate the crisis from the rest of the period in question. Between 2004 and 2008, the average price of a concert ticket increased by 7.85 percent a year, which is not as high as the trend for the top 200 between 1996 and 2003 but is still significantly higher than the per annum trend between 2004 and 2013. These higher prices were accompanied by a decreased amount of total shows for the year. The total number of shows decreased by 3.2 percent annually from 2004 to 2008 compared to an annual rate of -0.4 percent between 2004 and 2013. Both of these trends between 2004 and 2008 are statistically different from the general trend from 2004 to 2013 at the 5 percent significance level. Ticket price trend is significant at the 1 percent level. There are other examples like these, but the main point is that without acknowledging the effect of the crisis, the overall trend between 2004 and 2013 can be misinterpreted.

Excluding the crisis years, average ticket prices have not risen at the same pace as they did between 1996 and 2003. Moreover, the growth of both prices and revenues for top artists has slowed down after 2011 while total concert revenue overall is on the rise. At that time the crisis was over the hump. The question is what may have caused the slower growth rate? To answer this question, we turn to the rise of music streaming services in the next section.

5 Music streaming services

The origins of music streaming services lie within what Doerr et al. (2010) formally refer to as Content as a Service (CaaS) distribution models. With these models, content is provided over the Internet as a service without transferring ownership. Many music-streaming services have embraced a scheme that blends revenue generation from ads and subscriptions: freemium. Thomes (2013) refers to the business model as 'two-tier freemium model'. The challenge for freemium start-ups in general is to maintain a healthy balance between free and paid users. Anderson (2009) estimates paid users to be around 5 percent of total users on average, but the variance is quite high.

Today, music-streaming services have gained a significant foothold in the total recorded music market. In 2004, digital revenue accounted for a mere 1.5 percent of total revenue for record sales in the US, whereas in 2013, they accounted for 62 percent.[2] This growth is partially attributed to the rise of music streaming services, which worldwide rose from 9 percent of digital revenue in 2008 to 27 percent in 2013 with a total of 28 million paying subscribers.[3] The dramatic manner in which music streaming has altered the way music is distributed has certainly affected the way people listen to music.

Streaming services and information problems

As Maillard (2013) describes, music choice is characterized by an over-abundance of options, and the number of options only continues to grow. This can effectively be described as an information problem, for the consumer has no way of ever being completely informed about his options. While the Internet provides the tools to help consumers find their optimal consumption package, it also facilitates the availability of an unparalleled number of choices in terms of artists and songs for consumers.

The age of the Internet has brought new mechanisms that consumers can utilize to reduce their search costs. One such example that is relevant to music is recommendation systems that provide enhanced 'clerking' services by sorting music by genre, connecting related artists based on music characteristics and user listening behaviour, and providing easy to use interfaces. Furthermore, music streaming services 'advise' and 'tutor' by constructing personalized playlists, recommending new artists based on previous listening behaviour, and integrating expert music opinions into the recommendations. The culmination of these recommendation systems significantly lowers search costs and

[2] Based on information taken from the Recording Industry Association of America (RIAA) between 2004 and 2013.

[3] Based on information taken from the IFPI Digital Music Reports.

alleviates the information problem associated with finding the optimal music consumption package.

We surmise this means music-streaming services have made it easier for less popular and new artists to gain popularity and to acquire a larger group of people willing to buy a concert ticket. If this is true, the revenues from concerts would have become more evenly distributed among popular and less popular artists in the last few years. In the next section we test whether the distribution of revenues has indeed become more even in 2011-2013 compared to 2004-2010.

6 Distribution of prices and revenues

A comparison of total North American concert revenue with the total yearly revenues of the top 200 tours demonstrates a remarkable trend in the industry. In 2004, the total revenue for the concert touring industry in North America was $2.8 billion, while the total yearly revenue for the top 200 tours was $2.097 billion, thus accounting for 74.91 percent of total concert revenue. Between 2004 and 2013, the total yearly revenue for the top 200 tours grew by 4.5 percent per annum while the total revenue for concert touring grew by 7.1 percent, nearly one and a half times the growth rate. The differing growth rates resulted in the revenue share of the top 200 tours decreasing from 74.91 percent to 59.0 percent by 2013. This pattern reflects a strong shift towards a more even distribution of concert revenues.

Whereas the distribution of revenues became more skewed in 1996-2003 (cf. Krueger 2005), after 2004 the opposite occurred (see Figure 4). The same result occurs based on the Theil measure of inequality. The Theil measure has the advantage of satisfying the subgroup monotonicity axiom, which is necessary in order to make a claim about the overall distribution of revenue. The Theil measure for revenue within the top 200 tours in 2004 is 0.568 and decreases to 0.439 in 2013, a decrease of 22.8 percent. It is clear that the distribution of revenue among the top 200 did become more even.

To further explore this claim, we employ two variations of the Atkinson Index (A_ε). In addition to being subgroup decomposable, the Atkinson Index allows for greater weight to be placed on different ends of the income spectrum depending on the value of parameter ε. When ε approaches one, the Atkinson index becomes more sensitive to changes at the lower end of the income spectrum. We first calculate $A_{0.5}$ in order to show the results when relatively equal weight is given to changes across the income spectrum. The Atkinson index decreased from 0.254 to 0.194 between 2004 and 2013. We then calculate $A_{0.9}$ to test whether placing greater emphasis on changes at the lower end of the income spectrum alters the results. The Atkinson index then decreases from 0.405 in 2004 to 0.312 in 2013. The measure of inequality is lower when greater emphasis is placed on changes in the upper end of the income spectrum. The result is unsurprising given the existence of superstars in the sample.

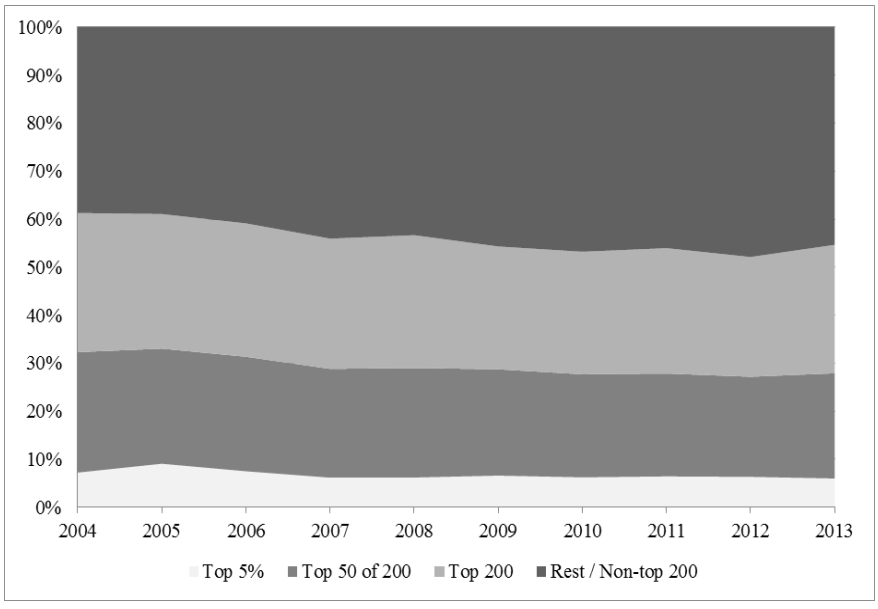

Figure 4: The gross annual revenue of concerts has become more evenly distributed, 2004-13. (Source: Pollstar).

The downward trend in inequality of annual gross revenue among artists is significant at the 95 percent level for both the Theil and Atkinson index. Because the Atkinson index and the Theil measure satisfy the subgroup monotonicity axiom, the decrease in revenue inequality within the top 200 tours also implies a decrease in revenue inequality for all music tours, assuming distribution of revenues among tours not in the top 200 remained the same or did not become more unequal.

The results for the distribution of ticket price show a slight decreasing trend in inequality, but this trend is – probably due to the small sample size – not significant for either the Theil or the Atkinson index. The evidence, shown by the price differential between the top 5 percent and bottom 95 percent of artists, suggests that the distribution remained stable, but the contrary evidence provided by the Theil measure complicates that claim. It is also more difficult than analysing the distribution of revenues because we have no price data for any artists outside the top 200. Considering that we surmise that much of the recent growth has come from those artists, it is hard to ignore the absence of that data. The measure is also sensitive to the removal of a few outliers, so the findings are not particularly robust. Nevertheless, it does not appear that the distribution of prices has become remarkably more uneven since Krueger's analysis.

6.1 Explaining the downward trend in equality by the LTD theory

Now that we know music-streaming services have influenced the distribution of popularity for artists, we look how this may be explained by using the *long tail distribution (LTD)* theory. Anderson (2008) argues that the future of entertainment lies not in a few big hits but rather in millions of niche markets. He attributes this change to the rise in Internet use and the proliferation of increasingly advanced recommendation systems, which allow consumers to better find their optimal choice of product, book, movie, or music. These recommendation systems can provide guide consumers down the 'long tail' thereby weakening the winner-take-all markets of superstars.

Empirical studies of movie and book markets have shown support for and against the trend towards the long tail distribution (Benghozi & Benhamou 2010; Peltier & Moreau 2012 respectively Elberse & Oberholzer-Gee 2006; Fleder & Hosanagar 2009), yet the three studies that focused on music supported the trend towards the LTD (Bourreau et al. 2013; Hendricks & Sorensen 2009; Maillard 2013). The high input costs to create a movie or book and the relative investment of people's time that it takes to consume them probably creates an inherent distribution of quality that is skewed towards a few superstars. This means the trend towards the LTD may not exist in these markets to a great extent. The market for music, however, is not inherently bogged down by the same high input and consumption costs, so the quality of options is more diverse. Thus, the superstar effect in this market, while certainly justified to some extent, is more so a victim of an information problem.

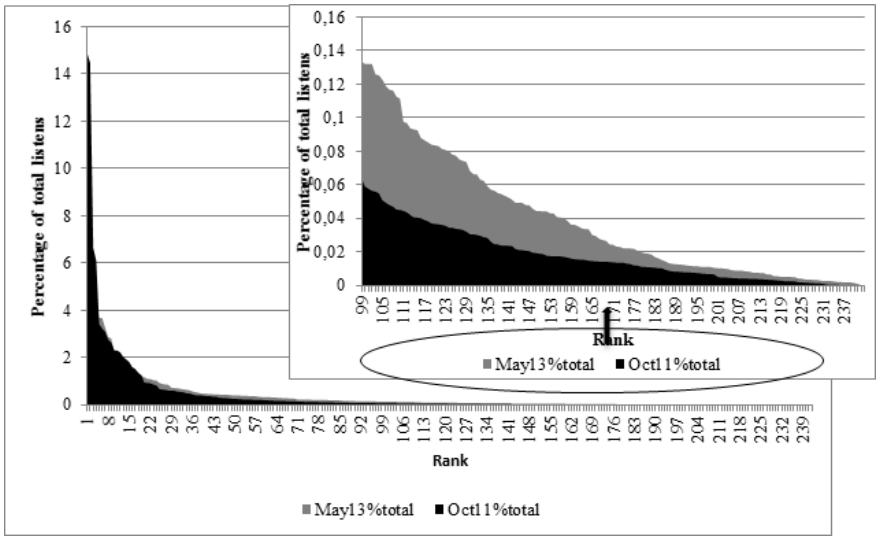

Figure 5: Growth from the long tail (percentage of total plays and the rank of each artist for October 2011 and May 2013) (N=21,780). (Source: MusicMetric).

To test this empirically we use data from Music Metric (see section 2). Figure 5 charts the percentage of total plays and the rank of each

artist for October 2011 and May 2013 in order to see if there is growth from the long tail. Each artist ranked 16th and below accounted for a higher percentage of total plays in May of 2013 than in October 2011. After rank 100, it is difficult to see the trend, so we include an enlargement in order to further demonstrate the growth from the long tail. The existence of superstars in the dataset does not necessarily exclude the possibility of a trend towards the LTD. The question we wish to answer is not whether the distribution of plays is even, but rather if it has become *more* even over time, as growth from the long tail implies greater equality.

In order to formally test this observation, we again calculate the Theil measure and Atkinson Index. We propose that the number of plays provides an approximation of the level of popularity of that artist, so a more even distribution of plays implies a more even distribution of popularity.

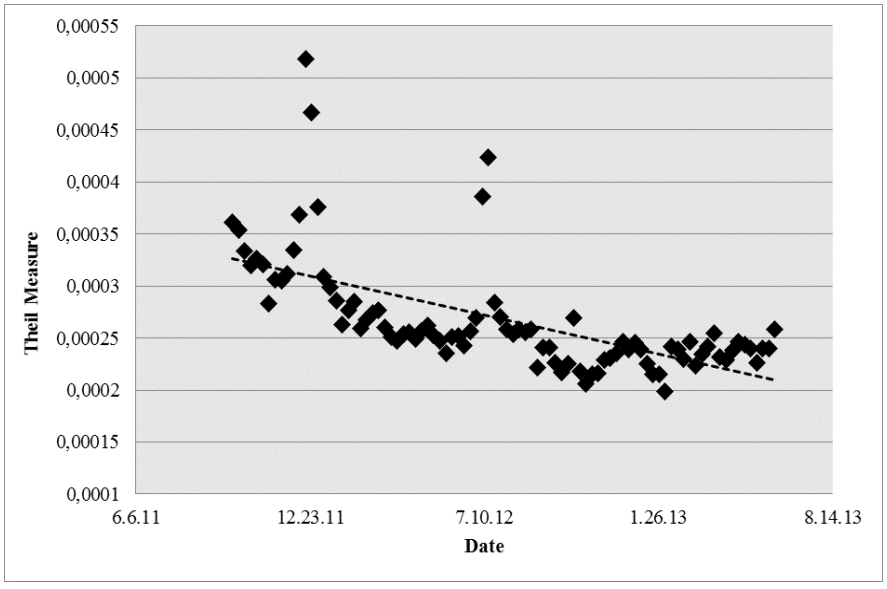

Figure 6: Theil measure points to the long tail (distribution of listens over time) (N= 21,780). (Source: MusicMetric).

Figure 6 shows the results for the Theil measure. Indeed, there is a significant decreasing trend in the Theil measure over time (significant at 1 percent level). There are a few outliers due to exceptionally high plays for single artists in a given week, but the general trend is clear. To bolster the robustness of this result, we also calculated the Atkinson Index ($\varepsilon = 0.5$) over time, which is shown in Figure 7. Again, there is a significant decrease in the inequality of plays but without the outliers of the Theil measure (again, significant at 1 percent level). Both analyses provide support for our hypothesis that the differences between less popular and popular artists have diminished the last few years, and that music streaming services may very well have something to do with that. In the next section we further demonstrate the equalizing effect of music streaming services.

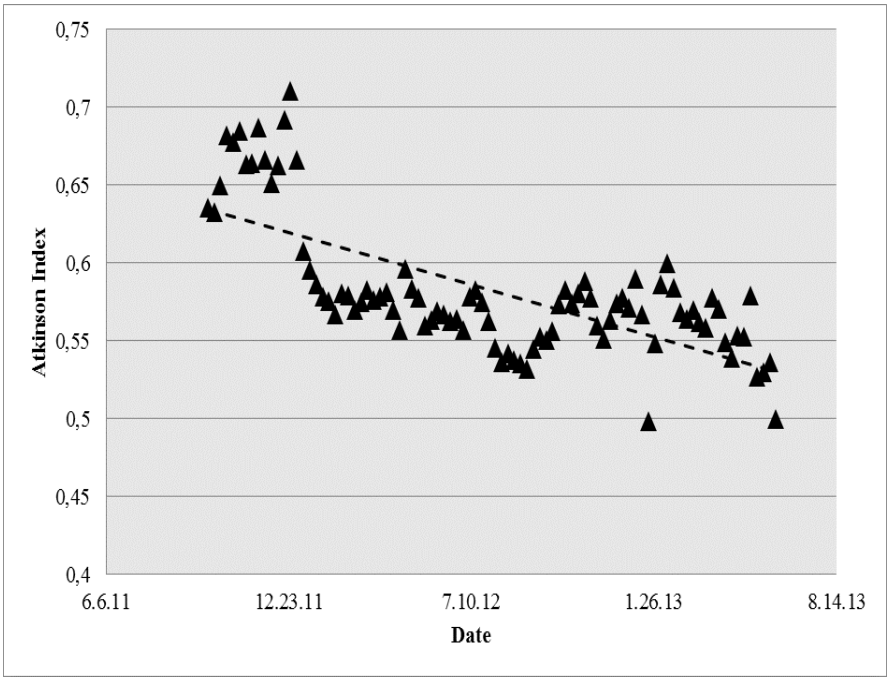

Figure 7: Atkinson provides further proof of the long tail (distribution of listens over time) (N= 21,780). (Source: MusicMetric).

7 Effect of streaming services on revenues and prices

If demand for concerts is influenced by the recorded music people listen to, then the changing music listening habits brought on by music streaming services have presumably affected concert ticket prices and revenues. First, we take a brief look at the literature. Then, we combine the datasets based on Pollstar and MusicMetric and empirically test the effect of steaming services on revenues and price.

Earl (2001) describes that the psychological and sociological aspects of concert attendance emphasize an 'experience' that cannot be reproduced. This implies that live concerts should not be considered substitutes for recorded music. A survey conducted by EMI shows that music streaming leads people to consume more music (Global Insights Survey 2011). Moreover, people who listen to more music attend more concerts (Montoro-Pons & Cuadrado-García 2011). Those who pirated or streamed more music also attended more live concerts. At the same time, they did not find evidence of a direct causal link from live attendance to recorded music demand, which supports Krueger's Bowie theory. Fusing the Bowie theory with Earl (2001), the ubiquity of recorded music encourages people to seek out complementary experiences, such as live concerts.

We now turn to our dataset covering the artists in the top 200 that performed in 2011, 2012 and 2013. We set up a simple model to assess how ticket prices may be explained by the number of listens by consumers who use music streaming services. Using a fixed effects panel regression model with robust standard errors, we found a positive and significant relationship between average weekly listens and average ticket price (table 2).[4] Using the same model, we found a positive and significant relationship between annual gross revenue and average weekly listens. Conversely, for average revenue per show, we found a negative and significant relationship with average weekly listens. To some extent, this can be explained by a regression of average weekly listens on the number of shows. When listens increase, the number of shows increase.

[4] Average weekly listens were divided by 1,000,000 to make the coefficients easier to interpret.

This is in line with the theoretical expectation described above, but in turn this tends to bring down the average revenue per show. However, annual gross revenue increases. Along similar lines, the relationship between average ticket sales and average weekly listens is negative and significant.

Concert Variable	Top 5	Not Top 5	All Artists
Average Ticket Price	-0.478	3.998**	0.629*
	(0.742)	(1.765)	(0.309)
Annual Gross Revenue	2.391***	4.683***	1.850**
	(0.330)	(1.266)	(0.815)
Average Revenue Per Show	53,678	-95,358	-115,518***
	(64,061)	(88,475)	(15,992)
Average Ticket Sales	351.6	-1,308	-1,746***
	(383.3)	(1,697)	(220.5)
Shows	1.792***	4.060***	1.910***
	(0.243)	(1.440)	(0.544)
Rank	-0.0338	3.550***	0.849***
	(0.0647)	(0.921)	(0.203)
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			*N=96*

Table 2: Effect of streaming services on revenues and prices (2011-2013)

Additional to these general results, we looked whether these relations differ for the most popular and less popular artists. We ranked each artist in ascending order by annual gross revenue and ran a regression of average weekly listens on rank. The result is a positive and significant relationship between rank and average listens. This suggests that as listens increase, rank increases. This result understandably follows the result of annual gross.

Finally, the data set was split into top ranked artists (the five artists with the highest annual gross revenue) and the rest to test whether the relationships in the subgroups are different. For the 'rest', we observed

similar relationships between average weekly listens and the concert variables but with higher coefficients. For example, the effect of average weekly listens on annual gross was significantly stronger for the 'rest' compared to the group as a whole (4.683 versus 2.391). In the case of average revenue per show/average ticket sales, the relationship turned out to be insignificant. For the top 5 artists, the results are significant for annual gross and shows. The coefficients for annual gross and shows are positive but lower in magnitude compared to 'the rest'. The difference between the slope of the top 5 and the 'rest' is significant at the 90 percent confidence level. For annual gross, the difference between the coefficients of the top 5 and the 'rest' is significant at the 90 percent confidence level. The difference between the slope of the top 5 and the total is not significant. Overall, these results suggest that listening behaviour affects the concert market, and this effect is more pronounced for lower ranked artists.

The results indicate artists with more weekly listens, are able to ask higher prices for their concerts and give more shows. Giving more shows decreases the average revenue per show. Still, the annual revenues increase with the number of weekly listeners. These relationships are stronger for less popular artists (that is, artists with lower annual revenues than the top 5 percent). This suggests that music streaming does indeed slow the growth of 'superstars' and distribute revenues more evenly. Because it is mainly the most popular artists who are responsible for the fast growth in concert prices, this might also explain how music-streaming services contribute to tempering this growth.

Our results fit the prediction of Gopal et al. (2006) that file sharing erodes the superstar phenomenon. According to Connolly & Krueger (2006) this implies that top artists actually lose from file sharing, but that less popular artists may gain from the extra exposure and lower distribution costs that the Internet has to offer. However, it is a mistake to say that the rise of music streaming has led to the end of superstars in the recorded music market. Rather, music-streaming services allow consumers to listen to the superstars and discover new, lesser-known artists. This has constrained the previously unbridled pricing power and brought

the growth in ticket prices between the top 5 and bottom 95 percent more or less in alignment.

8 Conclusion and discussion

Our analysis suggests that the concert industry continued to change after 2003, the end of Krueger's period of focus. Price growth between 2004 and 2013 was lower than between 1996 and 2003. Both the economic crisis and the rise of a new music distribution paradigm probably had a substantial effect on the concert industry.

The crisis put downward pressure on the trend of concert ticket prices and revenues, but it is a more nuanced view than one may expect. Ticket prices decreased in 2009 because of artist and promoter rational reaction to a depressed consumer climate. Ticket prices increased in 2010 because of miscalculated expectations of consumer demand, and this led to a decrease in revenues.

We demonstrated how music-streaming services are creating a more even distribution of demand for individual artist's concerts. The power of advanced recommendation systems provided by music streaming services helps consumers sort through the vast array of choices. This alleviation of the information problem suggests that the distribution of plays for artists should become more even. If plays are considered to be a proxy for popularity, then this also suggests the distribution of popularity for artists has become more even. The more even distribution of popularity of artists did indeed occur and influenced a more even distribution of concert revenues and a tempering of price increases. This reflects a trend towards Anderson's Long Tail Distribution. In sum, we find that the changes in consumption of recorded music have affected demand for concerts by influencing a more evenly distributed demand for individual artists while increasing demand for concerts in general.

Recommendations for further research

There are several approaches to further evaluate the concert industry. First, if it were possible to gain the same access as Krueger to the Pollstar Box-office Report database, a more in-depth analysis of the trends in ticket prices and revenues would be possible as that dataset would also include the venue size, capacity utilization, and price discrimination for each individual concert. Also, Krueger's dataset was not limited to the top 200 tours, which would allow for greater study of the 'long tail' of the concert industry. Second, re-evaluating the trends in a few years would allow for a better separation of the crisis years from the overall trend, as it would be beneficial to see where prices go in the next few years. Third, our MusicMetric dataset does not cover all music streaming services. For instance Spotify is not included in the dataset. It would be interesting to see how the results would change when using a broader dataset. Finally, more could be done on the changing role of price discrimination within a concert, which is a trend we were unable to evaluate adequately given the data. This could be linked with data on the secondary market, a relatively possibility given the rise of Internet resellers like EBay and StubHub, to see how close artists are to the market-clearing prices.

References

Andersen, B. & Frenz, M. (2007) "The Impact of Music Downloads and P2P File-sharing on the Purchase of Music: A Study for Industry in Canada". Available at: https://www.ic.gc.ca/eic/site/ippd-dppi.nsf/vwapj/IndustryCanadaPaperMay4_2007_en.pdf/$FILE/IndustryCanadaPaperMay4_2007_en.pdf .

Anderson, C. (2008) The Long Tail: Why the Future of Business is Selling Less of More, Hyperion Books, New York.

Anderson, C. (2009) Free: The Future of a Radical Price, Random House, Australia.

Benghozi, P.J. & Benhamou, F. (2010) "The long tail: Myth or reality?" International Journal of Art Management, vol. 12, pp. 43-53.

Blackburn, D. (2004) On-line piracy and recorded music sales. Job Market Paper Harvard PhD Programme, Unpublished manuscript: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.117.2922andrep=rep1andtype=pdf

Bounie, D., Bourreau, M. & Waelbroeck, P. (2005) "Pirates or explorers? Analysis of music consumption in French graduate schools", Telecom Paris Economics Working Paper No. EC-05-01.

Bourreau, M., Gensollen, M., Moreau, F. & Waelbroeck, P. (2013) "Selling less of more? The impact of digitization on record companies", Journal of Cultural Economics, vol. 37, no. 3, pp. 327-346.

Caves, R. E. (2003) "Contracts between art and commerce", The Journal of Economic Perspectives, vol. 17, no. 2, pp. 73-84.

Connolly, M. & Krueger, A. B. (2006) "Rockonomics: The Economics of Popular Music", in Handbook of the Economics of Art and Culture, vol. 1, eds V. A. Ginsburgh & D. Throsby, Amsterdam: North Holland, pp. 667-719.

Curien, N. & Moreau, F. (2009) "The music industry in the digital era: Toward new contracts", Journal of Media Economics, vol. 22, no. 2, pp. 102-113.

Dewenter, R., Haucap, J. and Wenzel, T. (2012) "On File Sharing with Indirect Network Effects between Concert Ticket Sales and Music Recordings", Journal of Media Economics, vol. 25, no. 3, pp. 168-178.

Doerr, J., Benlian, A., Vetter, J. & Hess, T. (2010), "Pricing of content services – An empirical investigation of music as a service", in: AMCIS 2010 Proceedings. Paper 36. Available at http://aisel.aisnet.org/amcis2010/36

Earl, P. E. (2001) "Simon's travel theorem and the demand for live music", Journal of Economic Psychology, vol. 22, no. 3, pp. 335-358.

Elbersee, A. & Oberholzer-Gee, F. (2006) Superstars and underdogs: An examination of the long tail phenomenon in video sales. Harvard Business School Working Paper Series, No. 07-015.

Fleder, D. & Hosanagar, K. (2009) "Blockbuster culture's next rise or fall: The impact of recommender systems on sales diversity", Management Science, vol. 55, no. 5, pp. 697-712.

Gayer, A. & Shy, O. (2006) "Publishers, artists, and copyright enforcement", Information Economics and Policy, vol. 18, no. 4, pp. 374-384.

Gopal, R. D., Bhattacharjee, S. & Sanders, G. L. (2006) "Do Artists Benefit from Online Music Sharing?" The Journal of Business, vol. 79, no. 3, pp. 1503-1533.

Hendricks, K. & Sorensen, A. (2009) "Information and the skewness of music sales", Journal of Political Economy, vol. 117, no. 2, pp. 324-369.

Johansson, D. & Larsson, M. (2009) The Swedish Music Industry in Graphs. Economic Development Report 2000-2008. Royal Institute of Technology, available at: http://ec.europa.eu/avpolicy/docs/other_actions/col_2009/pub/kth_annex.pdf

Krueger, A. B. (2005) "The Economics of Real Superstars: The Market for Rock Concerts in the Material World", Journal of Labor Economics, vol. 23, no. 1, pp. 1-30.

Liebowitz, S. J. (2006) "File sharing: Creative destruction or Just Plain Destruction", Journal of Law and Economics, vol. XLIX, pp. 1-27.

Maillard, S. (2013) Consumer Information in the Digital Age: Empirical Evidence from Spill overs in the Music Industry. Paper presented at the AFSE Meeting June 24-26, Association Française de Science Economique. Available at: http://www.touteconomie.org/afse/index.php/congres/2013/paper/viewFile/217/342

Montoro-Pons, J. D. & Cuadrado-García, M. (2011) "Live and pre-recorded popular music consumption", Journal of Cultural Economics, vol. 35, no. 1, pp. 19-48.

NDP (2012), Annual Music Study 2012, February, Washington.

Oberholzer-Gee, F. & Strumpf, K. (2007) "The effect of file sharing on record sales: An empirical analysis", Journal of Political Economy, vol. 115, no. 1, pp. 1-42.

Pareles, J. (2002) "David Bowie, twenty-first-century entrepreneur", New York Times, June 9, p. 30.

Peltier, S. & Moreau, F. (2012) "Internet and the 'Long Tail versus Superstar Effect' debate: Evidence from the French book market", Applied Economics Letters, vol. 19, no. 8, pp. 711-715.

Peitz, M. & Waelbroeck, P. (2006) "Why the music industry may gain from free downloading - The role of sampling", International Journal of industrial Organization, vol. 24, no. 5, pp. 907-913.

Pollstar (2011) 2010-Year End Business Analysis, 18 Feb. 2011, web publication.

Rosen, S. (1981) "The economics of superstars", The American Economic Review, vol. 71, no. 5, pp. 845-858.

Thomes, T. P. (2013) "An economic analysis of online streaming music services", Information Economics and Policy, vol. 25, no. 2, pp. 81-91.

Van Eijk, N., Poort, J. & Rutten, P. (2010) "Legal, Economic and Cultural Aspects of File Sharing", Communications and Strategies, vol. 77, no. 1, pp. 35-54.

Zentner, A. (2006) "Measuring the Effect of File Sharing on Music Purchases", Journal of Law and Economics, vol. 49, no. 1, pp. 63-90.