

# Bye, Bye, Miss American Pie?

## The Supply of New Recorded Music since Napster<sup>\*</sup>

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### Abstract

In the decade since Napster, most observers have concluded that file-sharing undermines the protection that copyright affords recorded music. What matters for consumers, however, is not sellers' revenue but whether the diminished appropriability will reduce the availability of new recorded works. The legal monopoly created by copyright is justified by its encouragement of the creation of new works, but there is little evidence on this relationship. The file-sharing era can be viewed as a large-scale experiment allowing us to check whether diminished appropriability stems the supply of new works. Using a novel dataset on the supply of new recorded music derived from retrospective critical assessments of music such as best-of-the-decade lists, we compare post-Napster album supply to 1) its pre-Napster level, 2) pre-Napster trends, and 3) a possible control, new song supply following the iTunes Music Store's revitalization of the single. We find no evidence that recent changes in appropriability have affected the quantity of new, acclaimed recorded music or new artists coming to market. We reconcile a stable flow of new works in the face of decreased demand with evidence on reduced costs of bringing works to market and a growing role of independent labels.

<sup>\*</sup>The title refers to Don McLean's song, *American Pie*, which chronicled a catastrophic music supply shock, the 1959 crash of the plane carrying Buddy Holly, Richie Valens, and the Jiles Perry "The Big Bopper" Richardson, Jr. The song's lyrics include, "I saw Satan laughing with delight/The day the music died." I am grateful to seminar participants at the Carlson School of Management and the WISE conference in St. Louis for questions and comments on a presentation related to an earlier version of this paper. The views expressed in this paper are my own and do not reflect the positions of the National Academy of Sciences' Committee on the Impact of Copyright Policy on Innovation in the Digital Era.

The decade since Napster has seen a stark drop in revenue to the recorded music industry that many observers attribute to file sharing. Between 1999 and 2008, annual revenue from physical recorded music products fell from \$12.8 billion to \$5.5 billion in the US after nearly continuous increases over the previous decades.<sup>1</sup> Even with digital sales included, US revenue was a third below its 1999 level. The decline is not confined to the US: Worldwide revenue from physical recorded music fell from \$37 billion in 1999 to \$25 billion in 2007. The struggles of the recorded music industry have spawned practitioner, policy maker, and academic debates over the role of unauthorized file sharing.<sup>2</sup> Although it is still controversial in some circles, most observers agree that file sharing is responsible for much if not most of the reduction in revenue to the recorded music industry. To put this another way, most observers agree that technological change has sharply reduced the effective degree of protection that copyright affords since 1999.

Organizations representing the recording industry have argued vigorously that piracy will have serious consequences for whether new artists' works will be brought to market and made available to consumers. According to the International Federation of the Phonographic Industry (IFPI), "[m]usic is an investment-intensive business... Very few sectors have a comparable proportion of sales to R&D investment to the music industry." But, according to a Warner Music official, "piracy makes it more difficult for the whole industry to sustain that regular investment in breaking talent."<sup>3</sup> The Recording Industry Association of America voices similar concerns: "Our goal with all these anti-piracy efforts is to protect the ability of the recording industry to invest in new bands and new music..." And: "this theft has hurt the music

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<sup>1</sup> See [http://www.riaa.com/keystatistics.php?content\\_selector=keystats\\_yearend\\_report](http://www.riaa.com/keystatistics.php?content_selector=keystats_yearend_report) , accessed April 28, 2010. Also, see Leibowitz (2006).

<sup>2</sup> Oberholzer-Gee and Strumpf (2006) initiated the contemporary empirical debate over file sharing. See also Rob and Waldfogel (2006), Blackburn (2004), Zentner (2006), among others.

<sup>3</sup> See [http://www.ifpi.org/content/section\\_news/investing\\_in\\_music.html](http://www.ifpi.org/content/section_news/investing_in_music.html) , accessed October 20, 2010.

community, with thousands of layoffs, songwriters out of work and new artists having a harder time getting signed and breaking into the business.”<sup>4</sup>

While the question of whether file sharing displaces legal sales and weakens copyright is an interesting academic question – and it is a vital question for the recorded music industry – it is arguably not the most important question about copyright raised by file sharing. Copyright has traditionally allowed the recording industry to get revenue from music sold on CDs. If economic returns provide the incentive for producers to make music, then factors threatening the ability of copyright to protect intellectual property may reduce the supply of new recorded music. While much existing research focuses on the effect of file sharing on demand for legal recorded music, the more important question for the well-being of consumers is the incentive effect of file sharing on the supply of recorded music.<sup>5</sup> If we grant that the reduction in recorded music revenue is due to piracy, then it plays the role of an exogenous shock to the appropriable demand for music via the copyright system. Thus, we can use the piracy decade as an experiment to ask whether reduced returns stem the supply of music.

Economists generally agree that monopolies are bad.<sup>7</sup> Governments grant some of the basic textbook examples of monopolies for intellectual property, in the form of patents and copyrights. Their bad effects – allowing prices above marginal costs and therefore restricting the supply of output – are thought to be justified by their incentive effects on production. But apart from introspection and anecdotes, we don’t really know much about the effects of remuneration incentives on production in the music industry. Paul McCartney recounts a famous

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<sup>4</sup> See <http://www.riaa.com/physicalpiracy.php>, accessed October 20, 2010.

<sup>5</sup> But see Handke (2006, 2009) and Oberholzer-Gee and Strumpf (2009), which we discuss further below.

<sup>7</sup> Boldrin and Levine (2008) remind us of this point in the specific context of protections for intellectual property. They also make the point, with interesting historical references, that music was produced for hundreds of years without intellectual property protection.

story that John Lennon, while remodelling his house, said to Paul, “OK! Today, let’s write a swimming pool.” And Paul continued, “It was a great motivation.”<sup>8</sup> But is the lesson of this anecdote true more generally? Does the prospect of greater rewards bring forth more music? If so, then the past decade, when the ability for sellers to generate revenue from recorded music has fallen as much as half, should be a dry period for music. This is the question we address in this study.

Characterizing the supply of creative products is difficult, particularly if one’s goal is quantify the effect of new products on welfare. The most natural measure – the number of new recordings available for sale – is quite imperfect. First, there is intense skew in the sales distribution for recorded music, making the link between the number of products and welfare unclear. New technologies have reduced the cost of creating new works, and the number of new recordings available has increased substantially. Yet – now as before – the vast majority of these products sell very few copies, casting doubt on whether the number of new works made available for sale would be proportional to welfare.

A natural second impulse is to want detailed data on prices and quantities of music purchased, along with other data, for estimating demand systems for calculating the consumer and surplus from new music. But even this approach faces a daunting challenge: Because of file sharing, an album of equal notional appeal released today rather than 15 years ago generates far less realized demand, simply because the willingness to pay has diminished in the face of unpaid

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<sup>8</sup> See “McCartney + Lennon Wrote Swimming Pool.” Contact Music, 23 August, 2005. (<http://www.contactmusic.com/new/xmlfeed.nsf/story/mccartney+-lennon-wrote-swimming-pool-song> , accessed October 8, 2010).

alternatives. Hence, the surplus implied by a demand system estimated in the file sharing era will understate the contribution of new products to welfare.

What we want is a measure of the number of products whose appeal surpasses some time-constant threshold. The index of appeal should be related to demand, but the index must be unaffected by file sharing so that it can be used to create an index of the supply of new creative goods over time, including the era of unpaid consumption. That is, we cannot quantify supply with, say, the number of albums selling more than 5000 copies. If file sharing undermines purchase incentives, then an album needs to be better now to garner 5000 sales than 15 years ago.

Our proposed solution to this conundrum is a time-constant quality threshold based on critics' retrospective lists of the best works of multi-year time periods. Our measure of supply is the number of albums released each year that surpass one of various quality thresholds based on critics' reviews. To quantify this, we have assembled data on album quality from 88 Anglophone sources, chiefly from retrospective lists (e.g. Rolling Stone's 500 best albums, Pitchfork Media's 200 best albums of the 1990s, etc.). Each of these rankings allows us to create an index of the number of albums released each year meeting the criterion. Because use of these data to measure supply is novel, we devote some effort to justifying the approach. We show that the indices are highly correlated with each other and that indices reflect well-known facts about music history. We also demonstrate that albums that are more highly regarded by critics sell more, which indicates that the indices are not simply reflective of critics' esoteric tastes. For brevity in expression, we will refer to these as indices of the volume of high quality music, although we understand that "quality" is a loaded term. What matters for us is that "quality"

designations provide a proxy for demand whose meaning is not undermined by file sharing. We use these indices to describe what has happened to the volume of high quality music made available since Napster. To this end, we develop simple regression models for splicing these indices together to produce overall indices of album supply before and after Napster. We document the evolution of this index surrounding Napster, and we also measure its movement relative to a plausible control, song supply since the 2003 launch of the iTunes Music Store.

The study proceeds in three sections. Section 1 provides the theoretical background linking file sharing to the well-being of consumers and producers in the short and longer run. Section 2 describes the various data sources employed in the study, along with evidence supporting our use of such data to measure music supply. Section three then reports our main results. Using indices collectively covering the period since 1960, we document that the annual number of new albums passing various quality thresholds has remained roughly constant since Napster, is statistically indistinguishable from pre-Napster trends, and that album supply has not diverged from song supply since iTunes' revival of the single format in 2003. We also document that the role of new artists in new recorded music products has not diminished since Napster. We offer a reconciliation of a stable quantity of acclaimed new products in the face of diminished demand with evidence of an outward shift in supply, reflecting reduced costs of bringing new works to market. We conclude with a discussion of what the results do – and do not – mean.

## **I. Welfare from Music**

### **1. Static and Dynamic Welfare Analysis**

Like any product, music generates surplus for two parties, buyers and sellers. While recorded music is durable in some senses – the recordings can last forever and can be reproduced digitally without degradation in quality – it is subject to taste depreciation. Obviously, there are exceptions. Many people still listen to classical music that is hundreds of years old. But for the most part, consumers prefer new music. There is direct evidence that music depreciates in Rob and Waldfogel (2006): consumers attach lower value to popular music, the longer they have owned it.<sup>9</sup>

The possibility that music depreciates is important for a welfare analysis of supply disruptions. If it did not, then the consumer losses from a disruption to new supply would be of only second-order importance. If the amount of music available increased a few percent in a normal year, then a complete cessation of new production would still leave consumers with nearly as much variety as they would have faced if new products had continued to arrive. If additional varieties are substitutes for existing varieties, then under typical assumptions, the failure to add relatively small numbers of products to the existing stock of available products would have small effects on welfare. But because most music does seem to depreciate for most users, disruptions to supply are potentially important for the welfare that this product delivers.

The welfare analysis of sharing zero-marginal-cost digital products has two parts, which could be termed static and dynamic. The static analysis describes music that already exists. It is easy to see that file sharing simply increases welfare. Producers lose, but their losses – when consumers steal things they used to pay for – are all transfers to consumers, who now enjoy

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<sup>9</sup> There is interesting variation across works' depreciation rates. Rob and Waldfogel (2006) estimate that the value that survey respondents attached to a Beatles album appreciated 26 percent per year of ownership while a Britney Spears album depreciated 28 percent annually.

greater surplus (the price they had formerly paid plus the former consumer surplus). In addition to the transfers from producers to consumers, file sharing also turns deadweight loss – circumstances in which consumers valued music above zero but below its price and therefore did not consume – into consumer surplus. In a purely static analysis, eliminating intellectual property rights benefits consumers more than it costs producers and is therefore beneficial for society.

Of course, the static analysis above is valid only for works that already exist. The dynamic analysis is different. If developing products requires investments of time or money, then producers may only make these investments in the hopes of obtaining returns. If the returns are eliminated, then producers may stop investing. If music fully depreciates in one period, then there is no supply available in the second period, and there is no surplus for either party. In contrast to the rosy static effects of file sharing on welfare, the dynamic impact is potentially devastating.

Intellectual property protections exist to provide the prospective rewards for creativity, in this context to ensure that new works continue to be brought forth in the “second period.” While it is customary to assume that IP protection provides such an incentive, there is actually very little evidence about its effect on music supply. This is the question we now turn to.

## 2. Measuring Supply

At first blush the obvious way to measure the supply of recorded music is with the number of songs or albums available. By extension, the new supply is the number of new songs

or albums available in, say, a given year. Oberholzer-Gee and Strumpf (2009) and Handke (2006, 2010) point to evidence that the number of albums released in the US and Germany – and that the number of labels operating in Germany – have not declined in the past decade to argue that file sharing has not interrupted supply. While this evidence is quite interesting, one might be concerned about that the great skew in the sales distribution undermines proportionality – and perhaps even the monotonicity – between titles and welfare. According to SoundScan, there were 97,751 new albums released in 2009, but only 2050 sold over 5000 units.<sup>10</sup> Thus, the amount of surplus generated is not proportional to the number of products made available, so the number of products provides an incomplete measure of the welfare effects of supply.<sup>11</sup> And while the evidence on the number of recording labels operating is quite interesting – more on this below at section IV – it is not by itself a measure of the amount of surplus that recorded music generates for consumers or producers.

An alternative approach is to measure supply as the number of albums that meet some importance threshold. For example, it might be informative to examine the number of albums selling over 5000 copies in a year. Apart from the fact that those data are hard to come by, it too seems potentially misleading. If we accept that sales are falling over time because of growth in unpaid consumption, then the threshold would have to vary over time for the number of albums above the threshold to maintain its meaning. We don't really know either the threshold nor its rate of decline, so this method does not seem promising. As argued in the introduction,

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<sup>10</sup> See Glenn Peoples. "Analysis: Important Sales Trends You Need to Know." *Billboard.Biz*, June 2, 2010.

<sup>11</sup> Variation in the number of new titles from one year to the next can also provide a misleading measure of new production. The number of new albums in SoundScan fell from 105,000 in 2008 to 97,751 in 2009 because "in recent years, digital distributors flooded online retail with foreign catalogs being licensed to new territories. In effect, these distributors are catching up to all the music that's available from around the world. ...this won't go on forever. As fewer and fewer old recordings find their way to U.S. retailers for the first time, the unique number of titles released in a given year will fall." See Peoples (2010).

estimating a demand system for purchases of recorded music would also not circumvent this problem.

While traditional approaches to quantifying the welfare effects of new products are stymied by the growth of piracy, there are other ways of quantifying the number of new albums meeting some importance threshold each year. Both professional and amateur music listeners are in the habit of rating and ranking their music. We can use these ratings and rankings as thresholds. We can then ask what is happening to the quantity of new music meeting any particular threshold over time.

## **II. Data and Reliability**

### **1. Sources**

The basic data for this study are professional critics' retrospective rankings of songs and albums from multiple years, such as "best-of-the-decade" lists. For these lists, the staff of a magazine or website produce a list of the best albums (or songs) of the past decade, or quarter century, or all time. That is, experts evaluate music from different years, subjecting all of it to a time-constant quality threshold for list inclusion. Prominent examples include Rolling Stone's 2004 list of the 500 best albums or Pitchfork Media's list of best 200 albums of the 2000s (see the Appendix Table 1 for a full list of the sources and their coverage). We have 88 different

rankings (and ratings), 64 covering albums and the remainder covering songs. All of the rankings are from Anglophone countries (the US, England, Canada, and Ireland).<sup>12</sup>

These rankings generate data of the form:  $\mu_1 > \dots > \mu_N$ , where  $\mu_i$  is the quality of work  $i$ . If  $T_k$  is a quality threshold such that  $\mu_k > T_k > \mu_{k+1}$ , then each of these rankings allows us to calculate the number of works above a constant  $T_k$  released in each year. These rankings allow ready creation of indices showing the volume of works released in each year that pass some threshold.

For example, Rolling Stone released its 500 best albums list in 2004. Entries on the “were chosen by 273 of the world’s pre-eminent musicians and critics ranging from Fats Domino to Moby” (Levy 2005). Figure 1 depicts the supply index derived from Rolling Stone’s list, and a few things are immediately evident. First, perhaps because Rolling Stone was founded in 1967, its editors are very fond of 1960s music. Second, the index trails off toward the year that the list appeared (2004). This may arise partly mechanically from the process of ranking: rankings released in a given year may be the result of a process begun a year earlier.

Most of our indices are based on retrospective lists, which – unlike ongoing reviews – allow their creators some chronological perspective on the works they rank. By construction, however, these rankings are assembled close to the last year of the period evaluated, giving rank creators less time to assess recent works. This gives rise to a bias against recent works in these rankings. For example, Pitchfork Media produced a list of the top 100 albums of the 1990s in October 1999, then another list covering the same period in November 2003. The latter list was

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<sup>12</sup> We discovered rankings in a variety of places. The Acclaimed Music website lists many of these, including the majority of the lists we use for the period since 1999. See, in particular, the lists of the top albums and songs of the 2000s at <http://www.acclaimedmusic.net/>, accessed December 21, 2010.

introduced with a statement contrasting it with their 1999 ranking, "...looking back at that list a lot has changed: our perceptions of the decade are different now, our personal tastes have expanded, our knowledge of the music has deepened..."<sup>13</sup> And, indeed, the later ranking includes a greater emphasis on the last years of the decade. Ten percent of the albums on the 2003 list were released in the last two years of the decade, compared with only seven percent for the 1999 list. Hence, we can use the retrospective rankings but exclude the year the ranking appeared as well as the previous year to avoid a bias against recent works.

The contemporaneous ratings reported at Metacritic provide a second sort of quality data. Metacritic translates reviews from multiple sources into a unified 100-point scale.<sup>14</sup> Reviews appear in Metacritic only when an album has been reviewed by at least three of the underlying sources that Metacritic incorporates. These sites do not review all of the albums released. Estimates of the number of new albums each year vary between 30,000 and 100,000; regardless, Metacritic produces reviews of only a small fraction. If the method for choosing albums for review were constant over time – so that an album of given quality were equally likely to be reviewed regardless of release year – then the number of albums passing a quality threshold would provide a clean measure of the quantity of new works exceeding some quality threshold. But album selection rules change over time, and the number of albums reviewed has grown steadily from 222 to nearly 500 from 2000 to 2007, then jumped roughly 60 percent in 2008.<sup>15</sup>

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<sup>13</sup> See <http://pitchfork.com/features/staff-lists/5923-top-100-albums-of-the-1990s/>, accessed October 18, 2010.

<sup>14</sup> "Metacritic's proprietary Metascore distills the opinions of the most respected critics writing online and in print to a single number." See <http://www.metacritic.com/about-metacritic>, accessed October 8, 2010.

<sup>15</sup> Metacritic's database includes 222 reviews from 2000, 300 for 2001, 362 for 2002, 429 for 2003, 457 for 2004, 477 for 2005, 506 for 2006, 486 for 2007, 805 for 2009, 976 for 2010, and 522 for 2010 (as of October 18, 2010). These figures are from <http://apps.metacritic.com/search/index.shtml>, accessed October 18, 2010.

Using Metacritic's all time best list, I have obtained the roughly 4700 albums that have received Metacritic scores above 61 between 2000 and late 2010. I calculate an index from the number of such albums released each year, then divide the index by the number of albums that Metacritic reviewed each year.

A third source of ranking/rating information might be termed wiki ratings. These begin with Zagat's survey based ranking of the top 1000 albums, released in 2003. Their list was based on a survey of 10,600 survey respondents who listened "to an average of 24.2 hours of music per week." Because Zagat's ranking book as published in September 2003, we exclude 2003 from the Zagat data for the mechanical reason that respondents cannot possibly have included as many 2003 albums. We also exclude 2002 to deal with the anti-recency bias discussed above.

Recently, various websites have emerged where users – amateur music aficionados – upload their rankings or ratings of music. Such sites include BestEver.com, where users upload their rankings, typically their top 50. As of October 2010, nearly 1900 individuals had uploaded their rankings. At RateYourMusic.com, users enter ratings of songs. Based on these user ratings, the sites produce rankings, for example the top 1000 albums of all time. A challenge with these rankings, particularly the latter two, is that users upload their rankings at different times. If a user uploaded his ranking in 2006, it will clearly not include works from subsequent years (and may not yet include recent works either). The overall rankings, aggregating rankings produced in different years, do not adjust for the different exposure of recent works, i.e. their depressed possibility of being included in users' rankings. The only "fair" comparisons from such rankings is over periods when all works are at risk of being included, that is the period prior

to when the first user made his ranking. RateYourMusic.com was founded in December 2000.<sup>16</sup> Bestever albums.com was founded in 2005.<sup>17</sup> Thus, these sources' overall rankings are valid only through 2000 and 2004, respectively.

A final sort of ranking that does not fit neatly into the scheme above are the list at Acclaimed Music, a site operated by a Swedish statistician who synthesizes over 100 different professional music critics' rankings to produce overall rankings of the top 3000 albums, and songs, of all time.<sup>18</sup> Acclaimed Music also produces rankings of the top albums – and top songs – of the decade 2000-2009, and they provide the underlying individual critical outlets' best-of lists, which we use directly. These included 56 album lists and 22 song lists from US, Canadian, and UK sources.<sup>19</sup> Together, the 64 album lists cover the period 1960-2007 and include 15,158 entries. The 24 song lists also cover 1960-2007 and include 1806 entries.

## 2. Data Validation

The first question we need to address is whether the data measure something meaningful. We would like to advance the interpretation that the data – on the number of songs or albums above some critics' threshold released in a year – provide a reasonable measure of supply. We can subject these indices to various tests of legitimacy. First, we can ask whether they track well-known historical trends in music. For example, historians of contemporary popular music

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<sup>16</sup> See [http://en.wikipedia.org/wiki/Rate\\_Your\\_Music](http://en.wikipedia.org/wiki/Rate_Your_Music), accessed October 20, 2010.

<sup>17</sup> See <http://www.besteveralbums.com/howitworks.php>, accessed October 20, 2010.

<sup>18</sup> See the “Questions & Answers” page at <http://www.acclaimedmusic.net/>, accessed October 27, 2010.

<sup>19</sup> We exclude lists that do not cover rock music generally. Thus, we exclude terrorizer (a metal-only list), the Times Jazz and World lists, and so on.

believe that the late 1960s was a period of unparalleled creative output in recorded music.<sup>20</sup> Do the indices reflect this?

Figure 2 shows the number of top albums released in each year from five separate rankings covering a long sweep of the history of rock music, Rolling Stone, Zagat, Rate Your Music, Acclaimed Music, and the BestEver site. All show spikes in the late 1960s, as well as a second spike in the mid-1990s. The Rolling Stone list is more heavily skewed toward the 1960s, relative to the other two, but all five provide some reflection that both the late 1960s and the early-to-mid 1990s were fertile periods for music. A second question is whether the indices are similar to each other. If the late 1960s was in fact an important period, then all indices should reflect this. Of the indices in Figure 2, all pairwise correlations exceed 0.7, except the correlations with Zagat (which lie between 0.05 and 0.53).

That the different indices, derived from independent assessments of music, are highly correlated provides some reassurance that the indices measure something meaningful about the each year's contribution to the supply of music. Moreover, the high correlations between indices based on amateurs' rankings (such as Zagat and, especially, BestEver and Rate Your Music) and indices based on professional critics' rankings (Rolling Stone and Acclaimed Music) provide assurance that the indices reflect recorded music products with broad appeal. However, the variation in musical output over time also suggests a caution: because there were no changes in the returns to creating music in the periods of high output, it appears that supply varies over time for reasons unrelated to the incentive effects we seek to examine in this study.

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<sup>20</sup> For example, Larkin (2007) writes, "The 60s will remain, probably forever, the single most important decade for popular music."

Because the period following 1999 is crucial to this study, it is important for us to provide evidence of the reasonableness of the rankings and resulting indices for the post-1999 period. We have 56 album lists – and 22 songs lists – covering this period (beginning in 2000). To determine whether these lists contain a common signal rather than simply noise, we do a few things. First, we examine overlap across lists.

Table 1 shows the albums appearing on the most lists. Two albums – *Funeral* by Arcade Fire and *Kid A* by Radiohead appear on 47 of the 56 lists covering the 2000s. *Is this It?* by the Strokes and *Stankonia* by Outkast appear on 45 and 37 lists, respectively. Figure 3 shows the overlap across lists more systematically, via an album Lorenz curve: 100 albums account for 40 percent of the entries on decade-best lists, 250 albums account for over 60 percent, and 500 albums account for over three quarters of the 4202 entries on 56 publications' best-of-the-2000s lists. At least 300,000 albums were released during the decade. Yet, 500 albums – less than 0.2% of the decade's new releases – account for three quarters of the entries on 56 critical best of the 2000s lists. Table 2 and Figure 4 repeat the exercise for songs, which exhibit a similarly substantial degree of overlap across the 22 song lists for the 1990s. The concordance far exceeds what would arise by chance and suggests a large systematic component to the determination of critics' rankings.

### 3. High Rankings and Sales

If the designation of being an acclaimed album is meaningful – relevant to whether the album's existence and consumption generated extra satisfaction for consumers – then critically

acclaimed albums should sell more. That is, our measure of supply should be relevant to the generation of additional economic surplus. While album sales data are generally difficult for researchers to obtain, one source of approximate US album sales data is the RIAA certifications. An album is certified “gold” with 0.5 million sales and “platinum” with 1 million. As sales pass the second or third million, etc., they receive additional “multi-platinum” certifications. The certifications thus allow the creation of a dataset with all albums over 0.5 million in sales, with categoric sales measures: 0.5 corresponds to sales between 500,000 and 1 million, 1 million corresponds to sales between 1 and 2 million, and so on. Critical acclaim and sales are linked. The most acclaimed albums of the 2000-2009 decade, in Table 1, also tend to have sold rather well. Half of the 50 albums on the list sold at least half a million copies.

We can explore this more systematically as well. The RIAA certifications data are available online, and I merged a dataset consisting of the cumulative sales of the 7700 certified albums as of 2004 with the Zagat (2004) album ratings. Zagat includes 1000 albums, and 610 of these also appeared among the RIAA certified albums. I merged these data and coded the Zagat-included albums as critically acclaimed (albeit by amateur critics). This is a slightly peculiar data set: it includes all albums selling over 0.5 million copies (up to 2004), as well as almost 400 critically acclaimed albums that were not certified and therefore (we can infer) sold fewer than 0.5 million copies. What the dataset is missing, of course, is the vast lot of albums that never reach “gold.”

A regression of log sales on a Zagat-rated indicator shows that rated albums sell roughly double the number of units, among the sample of largely RIAA certified albums. See Table 3, column (1). Columns 2 and 5 add year dummies, with similar results. Finally, column 3 adds

artist fixed effects. In this specification, the effect of certification is identified from the sales difference between an artist's rated and unrated albums. The effect size increases in size and significance: albums that are critically acclaimed sell more than twice as many copies. This relationship provides additional evidence that the number of critically acclaimed albums produced in a year is relevant to demand and therefore to consumer and producer surplus.

### **III. Results**

#### **1. Empirical Strategy**

We would like to measure the impact of decreased appropriability of recorded music ("Napster" for short) on the supply of new music. Ideally, we would have data on both an "experiment" and a "control." Here, we observe the experiment – the world that experienced Napster – but we have no obvious control. We can nevertheless make a few comparisons that are suggestive of the effect on supply since Napster. First, we can compare the post-Napster period with the dawn of the Napster era (1999), simply asking whether supply has contracted. This is of course imperfect as a way to measure Napster's effect because – as we have seen above – music supply exhibits trends even in the absence of shocks to appropriability (e.g. the peaks in creative output in the 1960s and 1990s). Second, if we think the pre-Napster trend in supply would have continued, then we can measure a possible contraction relative to a trend defined by the pre-Napster supply index. Third, we can use the supply of new songs – rather than albums – as a control and ask whether the supply of new albums shrinks relative to the supply of new songs, particularly following the appearance of the iTunes Music Store in 2003.

Even if we cannot know the supply that would have been available absent Napster, we can assess the most dire predictions concerning whether music supply has dwindled. That is, we can ask how the recent decade compares with the previous four decades.

## 2. Does the Volume of High Quality Music Decline Post-Napster?

Of our 64 album indices, 58 extend at least a few years into the post-Napster period. A glance at the various album indices gives little definitive indication of whether supply declines following Napster. Some appear to rise while others appear to fall. If each of the indices contains noise along with signal, we can get more information out of the indices by averaging them. However, indices vary substantially in the number of works included and, as a result, in their year-to-year variability as well. For example, the Paste Magazine list includes 50 albums for the 2000-09 decade, while the Pitchfork Media list includes 200 albums for the same period and our Metacritic data include over 4000 albums for roughly the same period. Because indices based on more underlying works should provide more accurate descriptions of each year's output, we weight indices in all what follows (we also report unweighted indices for comparison). Specifically, we weight by the number of works included in an index, divided by the number of years the index covers. Hence, the weight for Pitchfork's top 200 albums of the 2000s decade is 20, while the weight for SPIN's top 125 albums of the 25-years between 1985 and 2010 is 5.

We can measure the change in annual new works following Napster via the following weighted regression:

$\ln(y_{it}) = \mu_i + \alpha t + \epsilon_{it}$ , where  $y_{it}$  is album supply index  $i$  in time  $t$  (e.g. the number of albums from 2003 on Pitchfork's list of the top 200 albums of the 2000s),  $t$  is a time trend, and  $\mu_i$  is an

index-specific fixed effect, and the model is estimated for years following Napster. In this model  $\alpha$  shows the annual percent change in supply indices. As Table 4 shows, the weighted album and song indices exhibit no statistically discernible trends following Napster. Based on the post-1999 trends, there is little evidence that the supply of new works has increased or contracted since Napster.

While the post-Napster trend is interesting, it does not provide an estimate of the effect of Napster, except under the restrictive assumption that the supply would have remained constant at its 1999 level in the absence of Napster. A comparison of pre- and post-Napster supply indices has greater promise for revealing the effect of Napster on supply. While none of our individual indices of supply cover the entire period since 1960 (or even 1980), the series collectively cover the period back to 1960. If we could “splice” the series together, then we could construct a continuous index covering both a long period prior to Napster and the decade following Napster. Figure 5 shows the time periods covered by the 88 different indices.<sup>21</sup> Importantly, all consecutive years are covered by at least one series. For example, 78 series begin in 2000, but nine series cover both 1999 and 2000, effectively allowing us to construct a continuous series over the interval 1999-2000. All two-year intervals since 1960 are similarly covered.

We can describe the time pattern of new works supply with a regression with index dummies and flexible time dummies:  $\ln(y_{it}) = \mu_i + \theta_t + \epsilon_{it}$ , where  $\theta_t$  is a time effect common across indices for year  $t$  (and other variables are defined as above). We estimate this model using the weights described above. Figure 6 shows time series plots of the annual values of  $\theta_t$ , along with a vertical line in 1999. Dotted lines define the 95 percent confidence intervals.

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<sup>21</sup> The lines in Figure 5 cover only the years we do not exclude for reasons discussed in the data section.

Figure 7 repeats the exercise for songs. Because the regression dependent variable is in logs, the index is in percent terms.

All of the indices exhibit some decline following Napster. But all of the indices were also falling fairly steadily in the half decade prior to Napster. This suggests a second approach to measuring the effect of Napster, using the pre-Napster period to identify the trend in supply. That is, we can estimate the equation  $\ln(y_{it}) = \mu_i + \beta t + \alpha t \delta_t^{post} + \epsilon_{it}$ , where  $\delta_t^{post}$  is a dummy that is 1 for the period following 1999 and 0 before. The coefficient  $\beta$  shows the time trend pre-Napster, and  $\alpha$  measures the annual divergence in the supply growth rate following Napster. The key question in implementing this approach is how much pre-Napster data to include for identifying  $\beta$  (and therefore  $\alpha$ ). It is clear from Figure 6 that album supply was falling prior to Napster. If we begin the estimation with data from the mid-1990s, we will impose the assumption that music supply would have continued to decline following Napster. This will, in turn, cause  $\alpha$  to be positive, suggesting that music supply growth has diverged upward from its pre-Napster trend.

Of course, as we include more years of pre-Napster data, we can generate very different values for  $\alpha$ . Table 5 shows the different estimates obtained with different pre-Napster periods. For example, when the pre-Napster period begins in 1995, the growth rate in supply increases relative to the pre-existing trend; and this difference is statistically significant, and it swamps the pre-Napster rate of decline. This pattern holds for the other estimation starting dates, except for 1980. When we begin the pre-Napster period in 1980, both the pre-Napster trend and the post-Napster divergence are statistically insignificant. Thus, this approach provides no indication that supply patterns have changed, relative to pre-existing trends, following Napster.

A third approach is to find a suitable control for album supply. A potentially promising avenue is the comparison between songs and albums. While the returns to producing all recorded music fell after 1999, the appearance – and rapid rise – of the iTunes Music Store in 2003 re-established individual songs (“singles”) as highly marketable works. For example, in 1999 sales of singles stood at 62.5 million units, accounting for only 2 percent of US recorded music sales. In 2009, by contrast, singles sales stood at \$1.14 billion, or almost 15 percent of US recorded music sales.<sup>22</sup> Thus, while the rewards from producing albums appear to have fallen since 1999, the rewards from producing singles appear to have risen since 2003. If this is so, then we can compare the time pattern of creative supply of albums and singles to identify a copyright-induced effect on album supply relative to single supply. The evident date for the “experiment” is the 2003 appearance of the iTunes Music Store.

Figure 8 shows our index of album supply juxtaposed with our index of singles supply since 1980, based on separate album and song year effects from weighted regressions. At face, they look rather similar. We can test for an album supply effect (relative to the single) using the following model:

$$\ln(y_{it}) = \mu_i + \theta_t + \pi_1 \delta_i^{Napster} + \pi_2 \delta_i^{iTunes} + \epsilon_{it},$$

where  $\delta_i^{Napster}$  and  $\delta_i^{iTunes}$  are indicators that are zero until 1999 and 2003, respectively, and one thereafter. Table 6 reports results, and none of the coefficients on the indicators are statistically significant. Thus, this approach, like the others we have explored, provides no evidence of an effect of changed appropriability of albums, relative to songs, on album supply.

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<sup>22</sup> See RIAA’s 2003 Yearend Statistics and the RIAA’s 2008-09 shipment statistics at [http://www.riaa.com/keystatistics.php?content\\_selector=2008-2009-U.S-Shipment-Numbers](http://www.riaa.com/keystatistics.php?content_selector=2008-2009-U.S-Shipment-Numbers), accessed October 26, 2010.

### 3. New Artists vs New Music

The evidence thus far indicates no decline in the volume of new recorded music products forthcoming since Napster. It is possible, however, that the new music is coming from artists who were established prior to Napster. While products still come to market, it is possible that new artists are not establishing careers.

To explore this we examined the albums on three analogous best-of lists, for the 1980s, the 1990s, and the 2000s, from Pitchfork Media. For each of the 300 albums, we determined the year the artist released his, her, or their first recording (whether an album, a single, or an “EP”).<sup>23</sup> These data allow us to calculate the career age of an artist at the time he has an album on a best-of list. The question is whether artists have continued to establish careers since 1999. To explore this, we calculate the share of best albums since 1999 whose artists’ first recordings appeared after 1999. Since 1999, 49 percent of artists on the best of the 2000s list debuted following Napster. Figure 9 shows this year-by-year pattern: there is a systematic, although not a monotonic, rise from 10 percent of albums in 2000 to 100 percent at the end of the decade. On average, about half of the best-of albums since Napster are from artists whose recording debut occurred since Napster.

Although this is clearly a substantial share, determining whether the launching of new artists has changed requires a comparison with earlier periods. To this end, we calculate analogous annual shares for the two previous decades, the annual share of 1980s best-of albums from artists debuting after 1979, and the share of 1990s best-of albums from artists debuting after 1989. All three patterns are very similar, rising fairly steadily to 100 percent by the end of each

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<sup>23</sup> We obtained the discography information from <http://www.discogs.com>, accessed January 1, 2011.

decade. A regression of a dummy for whether an artist debuted since the decade of his appearance on dummies for years since the beginning of the decade and a dummy for the post-Napster decade confirms the lack a statistically meaningful difference in the tendency for new artists to appear on the list since Napster.

#### **IV. Discussion and Conclusion**

How do we reconcile the demand reduction wrought by piracy since Napster with the continued creation of new recorded music documented above? One possibility is that the supply curve is vertical, i.e. that creative activity is invariant to reward. While new music itself might be created without regard for reward, the mundane aspects of bringing it to market – production, promotion, and distribution – are generally undertaken by profit-seeking private firms, and they have costs which must be covered to keep new products coming forth. These are presumably the costs that concern IFPI and RIAA members. The intuitive reasonableness of an upward-sloping supply curve for new products suggests a different reconciliation of reduced demand with continued “output,” that new technologies have reduced costs, shifting supply out as demand has contracted. Bringing music successfully to market has three component activities – creation, promotion, and distribution – and new technologies have changed each of these substantially.

Creation includes both solitary artistic activity as well as recording, mixing, engineering, and manufacturing salable recorded music products. Many aspect of creation were traditionally expensive, but a succession of new technologies has reduced costs. Caves (2000) points out that the development of low-cost tape recording equipment after World War II “promoted the entry

of more than a thousand new record labels between 1948 and 1954.”<sup>24</sup> Kalmar (2002) notes that with the development of digital audio tape in 1987, “a label can set up their own recording studio for about five grand.”<sup>25</sup> The cost reductions have accelerated since Napster: Software such as Pro Tools turns an inexpensive personal computer into a home recording studio. A starter version of the software sells for about \$100.<sup>26</sup>

Music is an experience good, and consumers need to become aware of music to be interested in purchasing it. Record companies have traditionally made consumers aware of their products by promoting their new releases on radio. Even prior to the Internet, the labels produced more music than radio stations could air, so the labels paid the stations to promote their music. While the literal practice of “payola” was outlawed in 1960, labels continued to pay for airplay through independent promoters, “men (large and accompanied by bodyguards) who were willing and able to gain control of radio stations’ playlists.” These payments were substantial: in 1985 the record labels collectively paid \$65 million for airplay when the industry’s pre-tax profit was \$200 million. The cost of promoting a hit single was about \$150,000.<sup>27</sup>

Since Napster, the process of musical discover has changed substantially. While radio listening is in decline, consumers now learn about new music from a variety of web sources, including Pandora, MySpace, and YouTube. According to the 2010 “Infinite Dial” study conducted by Edison Research and Arbitron, the Internet was by far the most popular medium that consumers age 12-34 used first to learn about new music. Over half (52 percent) turned first

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<sup>24</sup> See Caves (2000), pp. 157-8.

<sup>25</sup> See Kalmar (2002), p. 73.

<sup>26</sup> See Donald Bell, “Avid Introduces new Pro Tools Studio Bundles.” CNET, Oct 1, 2010 ([http://news.cnet.com/8301-17938\\_105-20018292-1.html](http://news.cnet.com/8301-17938_105-20018292-1.html), accessed October 28, 2010).

<sup>27</sup> Caves (2000), p. 292, provides the source for the quote and the data cited in this paragraph.

to the Internet, followed by 32 percent using radio. Just over a quarter (27 percent) of the population 12 and over had used Internet radio in the previous month, and Pandora was the most recognized name: among those who had ever listened to Internet radio, 28 percent named Pandora, followed by Yahoo Music (9 percent), AOL Radio (6), and Last.fm (4).<sup>28</sup> As the Infinite Dial name suggests, the Internet has undermined the scarcity of terrestrial radio stations as music promotion channels.

Distribution, too, has been changed substantially by the Internet. Caves (2000) emphasizes a number of factors favoring large scale enterprises in physical distribution during the physical era, including a need to get a large quantity of physical product into many stores before popularity wanes. Of course, it is now possible to distribute musically electronically, eliminating inventory issues. Using TuneCore's service, for example, an artist can make his song available on iTunes for \$9.99.<sup>29</sup> Clearly, the various costs of bringing music to market have come down substantially since Napster.

In his critical account of the music industry's response to digital transformation, Steven Knopper (2009) argues out that these changes largely obviate the roles of the major record labels:

[Prior to Napster, an] "artist who wanted to make a record needed studio time – and that cost money, which meant a sizable loan from a label. An artist who wanted to get a single onto a radio playlist needed connections – and that usually meant a label executive who had the money to hire an independent promoter. An artist who wanted to sell millions of copies of a record needed a big-time distributor with the clout to push CDs into big stores like Best Buy or Target – and that meant one of the label's own subsidiaries, like WEA or CEMA. Today, it's not necessary to hook up with a label to do all these things. An artist can make a record cheaply, and professionally, using software like Pro Tools. An artist can forgo

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<sup>28</sup> See "The Infinite Dial 2010: Digital Platforms and the Future of Radio." ([http://www.fmqb.com/goout.asp?u=http://www.edisonresearch.com/home/archives/2010/09/the\\_american\\_youth\\_study\\_2010\\_part\\_one\\_radios\\_future.php](http://www.fmqb.com/goout.asp?u=http://www.edisonresearch.com/home/archives/2010/09/the_american_youth_study_2010_part_one_radios_future.php) accessed October 28, 2010).

<sup>29</sup> See <http://www.tunecore.com/>, accessed October 28, 2010. At the site: "What Does Worldwide Distribution Cost" \$9.99 per single, \$9.99 per ringtone, \$49.99 per album."

the radio, building buzz and exposure online via do-it-yourself websites like MySpace, viral videos on YouTube, or any number of social networking services from Facebook to Garageband.com. As for distribution, who needs crates, trucks, warehouses, stores, or even the discs themselves?”<sup>30</sup>

Leeds (2005) makes the similar point that independent labels appear to have lower costs,

allowing them to subsist on smaller sales:

“Unlike the majors, independent labels typically do not allocate money to producing slick videos or marketing songs to radio stations. An established independent like Matador Records - home to acts including Pretty Girls Make Graves and Belle and Sebastian - can turn a profit after selling roughly 25,000 copies of an album; success on a major label release sometimes doesn't kick in until sales of half a million.”

Changes in the cost structure of operating a record label are consistent with Handke's (2006) observation that the number of German record labels expanded following the advent of file sharing.

Do the data support the contention that independent labels are bringing forth more of the supply following Napster? Pitchfork Media's ranking of the top albums of the 1980s, 1990s, and the 2000s includes each album's issuing label or, more commonly, a less recognized entity that may be either an independent label or a sub-label of one of the majors. Using mostly Wikipedia entries, I have been able to code each of the labels on the top 100 albums of each decade as either a major or an independent. This is not a trivial task, as the major owners produce records under a long list of label imprints.

The data provide support for the idea that independent labels are playing an increasing role (see Figure 10). While the share of the top 100 on independent labels was 50 percent in both

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<sup>30</sup> See Knopper (2009), p. 246.

the 1980s and the 1990s, it rose to 60 percent in the period since 1999.<sup>31</sup> This difference (between the 2000s and the previous two decades) is significant at the 5 percent level in a one-sided test ( $p\text{-val}=0.04$ ). The ascendance of independent labels has been noted elsewhere.

Leeds (2005) writes of the independent labels' success in the face of the majors' difficult times:

“Even as the recording industry staggers through another year of declining sales over all, there are new signs that a democratization of music made possible by the Internet is shifting the industry's balance of power. ...But no factor is more significant than the Internet, which has shaken up industry sales patterns and, perhaps more important, upended the traditional hierarchy of outlets that can promote music. Buzz about an underground act can spread like a virus, allowing a band to capture national acclaim before it even has a recording contract, as was the case this year with Clap Your Hands Say Yeah, an indie rock band.”

The heightened role of independent labels suggests a simple reconciliation of the continued supply of music despite financial distress at major labels: it appears that entities other than the major labels are bringing forth a higher share of music in the period since Napster.

The new era may not stem the supply of music, but it may change the industrial organization of the music industry, much in the way that competition from pure long-distance sellers forced unbundling of local and long distance services. It appears that majors have traditionally cross subsidized their exploratory activity – investing in new artists – with exploitative activities, selling predictably successful albums by already-popular artists. The independents appear to be able to participate in exploratory activities without needing to find artists who will generate sufficient revenue for cross-subsidization. And while major labels facing financial distress may be able to invest less in new artists, it is also possible that these artists' music can nevertheless find its way to market via the less costly distribution channel that independent labels provide.

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<sup>31</sup> Pitchfork's focus on artists they view as interesting likely explains the high share of independent label releases among their most highly rated albums. According to Leeds (2005), independent labels' collective share of recorded music revenue rose to 18 percent (27 percent including indie albums distributed by majors) in 2005, its highest share in 5 years.

This still begs the question of why artists themselves would continue to produce works in the face of the smaller payoffs promised even by a successful independent label release. Many observers point to heightened roles of complements to recorded music in artists income. Connolly and Krueger (2006) and Mortimer, Nosko, and Sorenson (2010) document that concert revenue has increased since Napster, and Shapiro and Varian (1999) emphasized the possible stimulating effect of widely available – and difficult-to-protect – recorded music on the sale of other complements such as t-shirts.

File sharing has presented a great challenge to the recording industry. It is clear to most observers that file sharing has undermined the effective copyright protection afforded to recorded music. In spite of this, the supply of recorded music appears not to have fallen off much since Napster, and there is at least suggestive evidence that independent music labels, which operate with lower breakeven thresholds, are playing an increased role in bringing new works to market.

This is a relatively difficult topic to study, so more than the usual number of caveats is in order. We lack a compelling counterfactual for the post-Napster musical world, so it is hard to measure Napster's effect on music supply with great confidence. It is possible that, absent the demand contraction, the cost reductions would have ushered in a substantial increase in the supply of new high-quality works. Second, even if it is true that music supply remains forthcoming in the face of weakened effective copyright protection, it is not clear what relevance these results have for other media that differ in their creative processes. While new recording and distribution technologies have put the means to make and distribute music in the reach of many more people, it remains substantially more costly to create other types of works, such as movies. Even if one takes the suggestive results of this study to mean that copyright protection

is not vital to ensure continued supply in music, we have no evidence that these lessons carry over to other media. It is often said – and is as true as ever in this context – that more research is needed.

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Figure 1

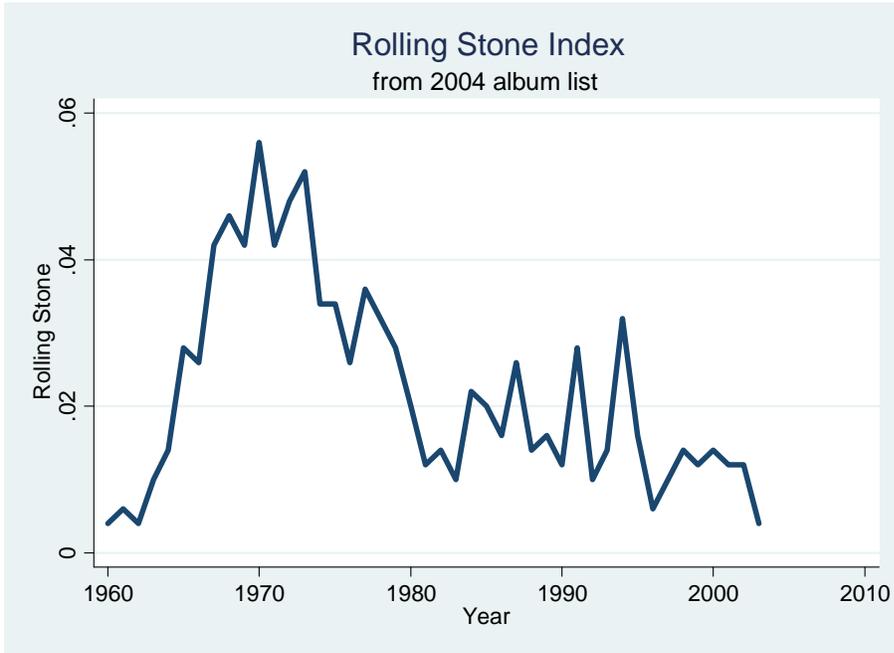


Figure 2

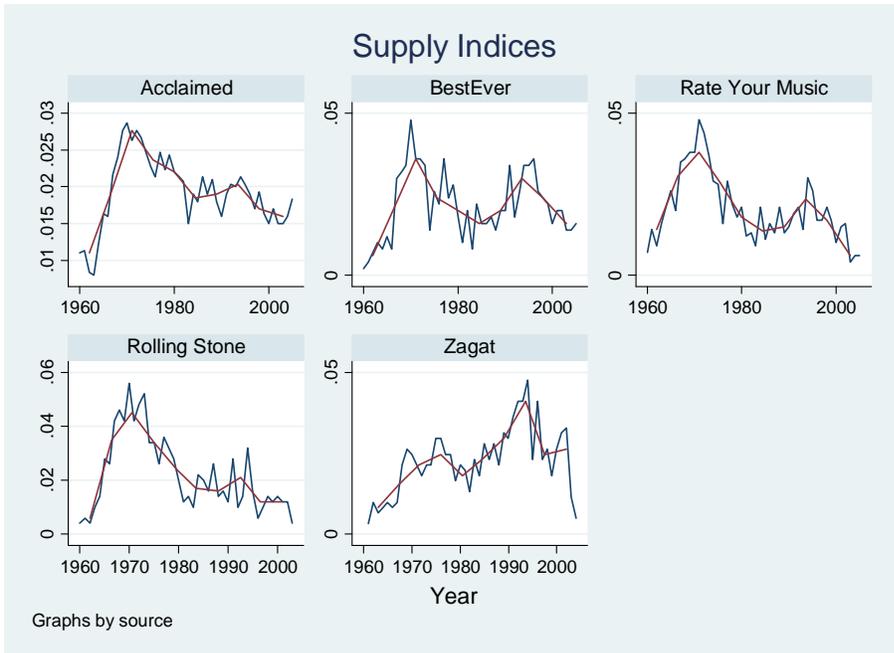


Figure 3

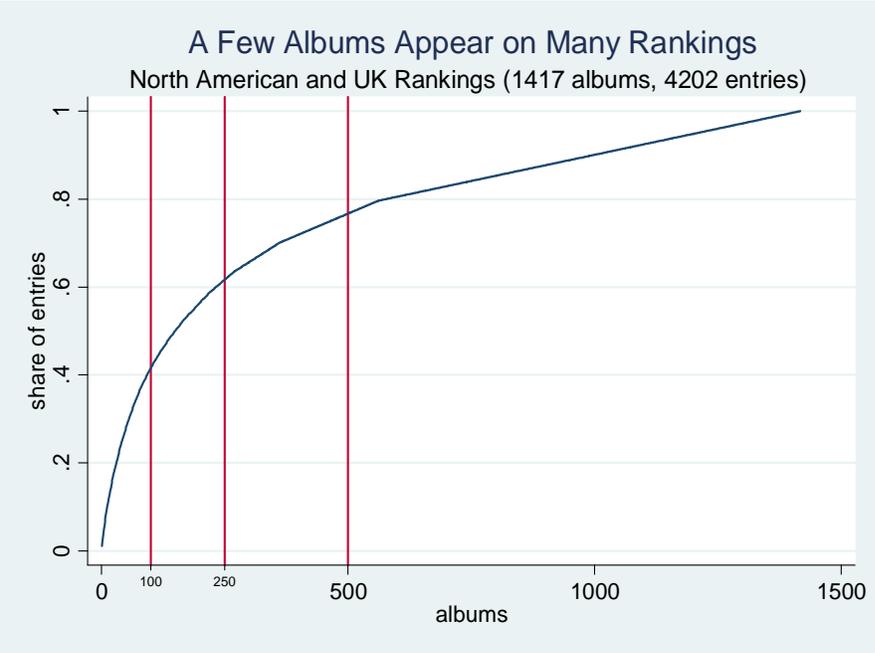


Figure 4

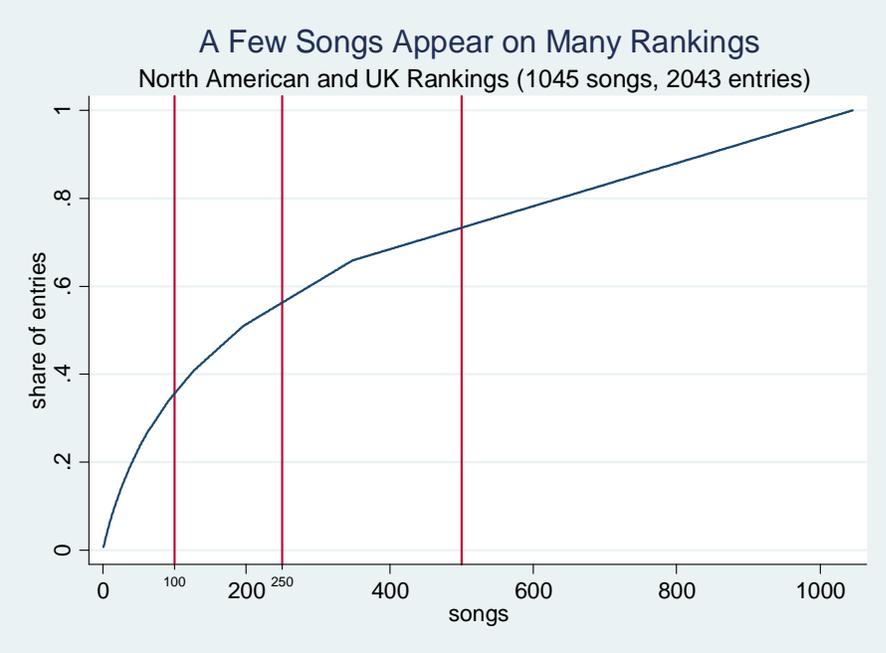




Figure 7

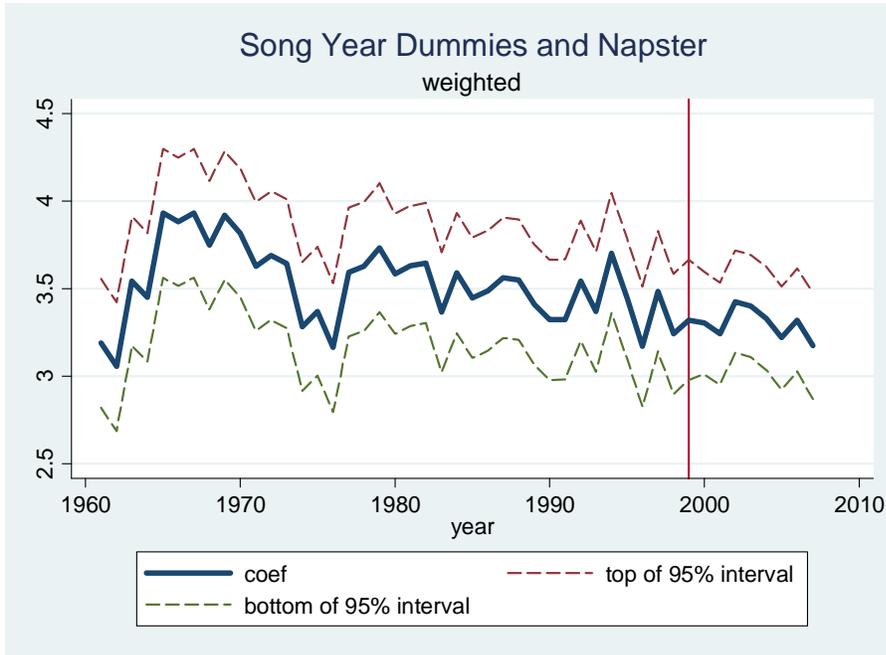


Figure 8

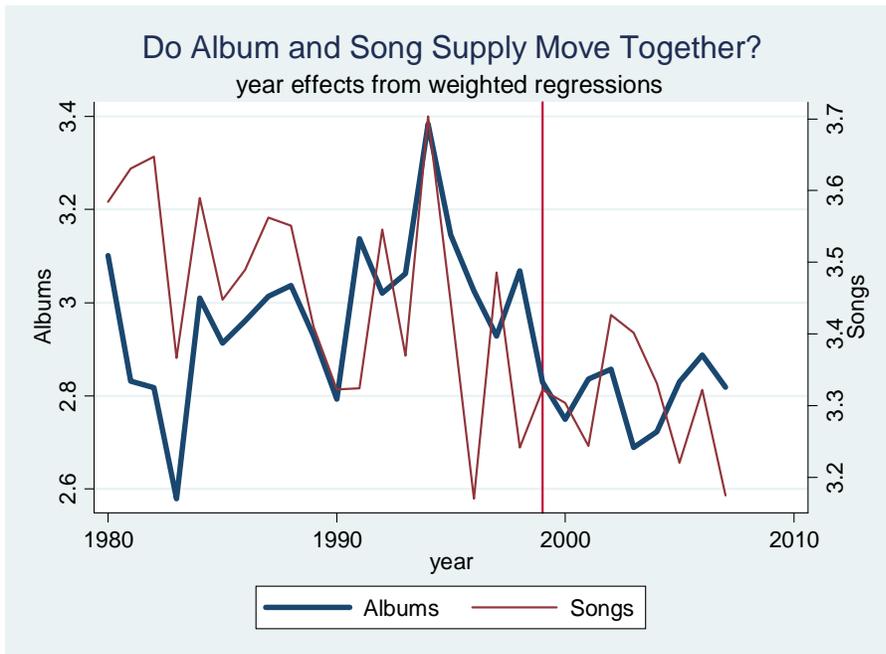


Figure 9

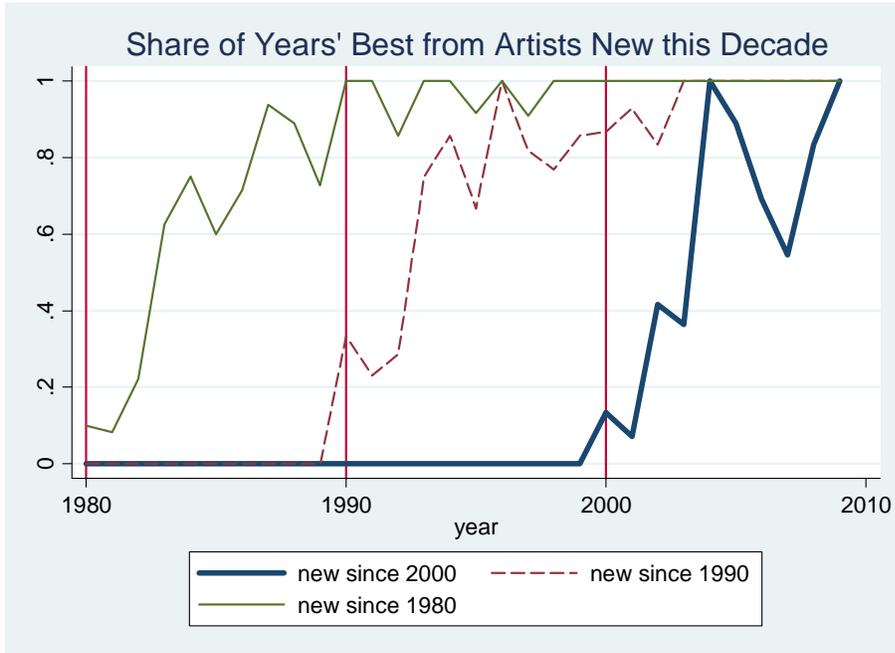


Figure 10

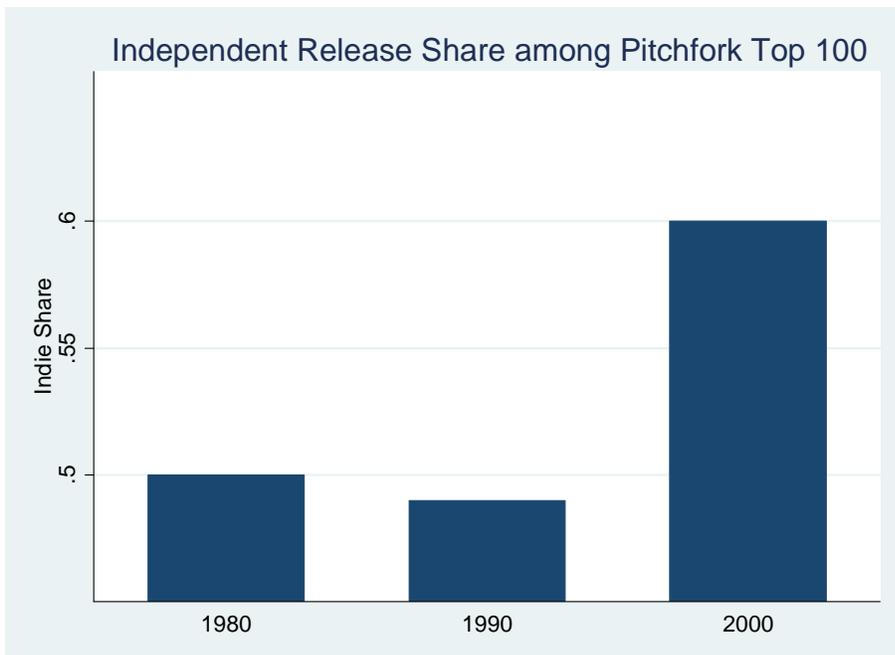


Table 1: The Most Listed Albums of the 2000s

rank	artist	album	year	Number of lists	RIAA Certs
1	Arcade Fire	Funeral	2004	47	
2	Radiohead	Kid A	2000	47	P
3	Strokes, The	Is This It	2001	45	G
4	OutKast	Stankonia	2000	37	3xP
5	Wilco	Yankee Hotel Foxtrot	2002	36	G
6	LCD Soundsystem	Sound of Silver	2007	34	
7	Jay-Z	The Blueprint	2001	34	2xP
8	Radiohead	In Rainbows	2007	30	G
9	Flaming Lips, The	Yoshimi Battles the Pink Robots	2002	29	G
10	White Stripes, The	Elephant	2003	29	P
11	Bon Iver	For Emma, Forever Ago	2007	28	
12	Stevens, Sufjan	Illinois	2005	28	
13	Arctic Monkeys	Whatever People Say I Am, That's What I'm Not	2006	27	
14	Daft Punk	Discovery	2001	27	G
15	West, Kanye	The College Dropout	2004	26	2xP
16	Winehouse, Amy	Back to Black	2006	26	2xP
17	Harvey, PJ	Stories from the City, Stories from the Sea	2000	26	
18	Interpol	Turn On the Bright Lights	2002	25	
19	White Stripes, The	White Blood Cells	2001	24	G
20	Eminem	The Marshall Mathers LP	2000	23	9xP
21	Knife, The	Silent Shout	2006	23	
22	Animal Collective	Merriweather Post Pavillon	2009	22	
23	M.I.A.	Kala	2007	22	G
24	Björk	Vespertine	2001	21	
25	TV on the Radio	Return to Cookie Mountain	2006	21	
26	Beck	Sea Change	2002	20	G
27	Broken Social Scene	You Forgot It in People	2002	20	
28	Modest Mouse	The Moon & Antarctica	2000	20	G
29	Streets, The	Original Pirate Material	2002	20	
30	Fleet Foxes	Fleet Foxes	2008	20	
31	Dylan, Bob	Love and Theft	2001	19	G
32	Burial	Untrue	2007	19	
33	Newsom, Joanna	Ys	2006	19	
34	Yeah Yeah Yeahs	Fever to Tell	2003	19	G
35	Dizzee Rascal	Boy in da Corner	2003	19	
36	Antony and The Johnsons	I Am a Bird Now	2005	18	
37	Vampire Weekend	Vampire Weekend	2008	18	G

38	Adams, Ryan	Heartbreaker	2000	18	
39	M.I.A.	Arular	2005	17	
40	Panda Bear	Person Pitch	2007	17	
41	OutKast	Speakerboxxx/The Love Below	2003	17	11xP
42	Queens of the Stone Age	Songs for the Deaf	2002	16	G
43	Jay-Z	The Black Album	2003	16	
44	National, The	Boxer	2007	16	
45	Bright Eyes	I'm Wide Awake It's Morning	2005	16	
46	Madvillain	Madvillainy	2004	16	
47	West, Kanye	Late Registration	2005	15	3xP
48	At the Drive-In	Relationship of Command	2000	15	
49	Ghostface Killah	Supreme Clientele	2000	15	G
50	Postal Service, The	Give Up	2003	15	G

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Based on 56 "best of the 2000s" album lists from North America and the UK.

Table 2: The Most Listed Songs of the 2000s

rank	artist	song	year	On how many of the 22 lists?
1	M.I.A.	Paper Planes	2007	15
2	Jay-Z	99 Problems	2003	14
3	Gnarls Barkley	Crazy	2006	14
4	The White Stripes	Seven Nation Army	2003	14
5	Beyoncé feat. Jay-Z	Crazy in Love	2003	13
6	Yeah Yeah Yeahs	Maps	2003	13
7	Franz Ferdinand	Take Me Out	2004	13
8	OutKast	Hey Ya!	2003	13
9	The Flaming Lips	Do You Realize??	2002	12
10	Missy Elliott	Get Ur Freak On	2001	12
11	Daft Punk	One More Time	2000	11
12	OutKast	B.O.B. (Bombs Over Baghdad)	2000	11
13	Kylie Minogue	Can't Get You Out of My Head	2001	11
14	Rihanna feat. Jay-Z	Umbrella	2007	10
15	Justin Timberlake	Cry Me a River	2002	10
16	OutKast	Ms. Jackson	2000	10
17	LCD Soundsystem	Losing My Edge	2002	10
18	The Knife	Heartbeats	2003	10
19	Radiohead	Idioteque	2000	10
20	The Rapture	House of Jealous Lovers	2002	10
21	R. Kelly	Ignition (Remix)	2003	10
22	Kanye West	Jesus Walks	2004	10
23	Amy Winehouse	Rehab	2006	9
24	Modest Mouse	Float On	2004	9
25	The Shins	New Slang	2001	9
26	Britney Spears	Toxic	2003	9
27	Eminem	Lose Yourself	2002	9
28	The Strokes	Last Nite	2001	8
29	Arcade Fire	Wake Up	2004	8
30	Peter Bjorn and John	Young Folks	2006	8
31	Queens of the Stone Age	No One Knows	2002	8
32	MGMT	Kids	2008	8
33	Hot Chip	Over and Over	2006	8
34	The White Stripes	Fell in Love With a Girl	2002	8
35	Jay-Z	Izzo (H.O.V.A.)	2001	8
36	LCD Soundsystem	All My Friends	2007	8
37	Kelly Clarkson	Since U Been Gone	2004	8

38	Johnny Cash	Hurt	2002	8
39	The Killers	Mr. Brightside	2003	7
40	The Postal Service	Such Great Heights	2003	7
41	Arcade Fire	Rebellion (Lies)	2004	7
42	Animal Collective	My Girls	2009	7
43	Radiohead	Pyramid Song	2001	7
44	Eminem feat. Dido	Stan	2000	7
45	Arctic Monkeys	I Bet You Look Good on the Dancefloor	2005	7
46	The Walkmen	The Rat	2004	7
47	TV on the Radio	Wolf Like Me	2006	7
48	T.I.	What You Know	2006	7
49	Lil Wayne	A Milli	2008	7
50	The Strokes	Hard to Explain	2001	7

Based on 22 North American and UK lists.

Table 3: Zagat Ratings and Album Sales

	(1)	(2)	(3)	(4)	(5)
	linear	linear	linear	interval	interval
Zagat Rated	1.084 (0.064)**	1.224 (0.066)**	2.146 (0.082)**	1.078 (0.066)**	1.227 (0.068)**
Year effects	No	yes	Yes	No	Yes
Individual FE	no	no	yes	no	no
Observations	8126	8126	8113		
R-squared	0.03	0.06			

Notes: Columns 1-3 report linear regressions. Uncertified albums are coded with 0 sales. The dependent variable for other observations are the RIAA certification level. Columns (4) and (5) report normal interval regressions. Uncertified albums are assumed to sell between 0 and 0.5 million, Gold albums are assumed to sell between 0.5 and 1 million, and N x multiplatinum albums are assumed to have sold between N and N+1 million copies. Standard errors in parentheses. \* significant at 5% level; \*\* significant at 1% level.

Table 4: Time Trends in Music Supply Following Napster

	(albums)	(songs)
Year	0.0071 (0.0063)	-0.0104 (0.0089)
Constant	-14.0067 (12.5821)	20.9655 (17.8453)
Observations	454	176
R-squared	0.88	0.93

Note: weighted regression of log index values following 1999 on index dummies (source fixed effects) and a linear time trend (year). Standard errors in parentheses. \* significant at 5% level; \*\* significant at 1% level.

Table 5: Napster Effect on Albums Relative to Pre-Napster Trend

	(1)	(2)	(3)	(4)
Year	-0.0772 (0.0202)**	-0.0238 (0.0076)**	0.0000 (0.0032)	-0.0144 (0.0019)**
Post-1999 Divergence	0.0835 (0.0225)**	0.0253 (0.0111)*	-0.0056 (0.0078)	0.0153 (0.0074)*
Constant	154.5180 (40.3130)**	47.7673 (15.2735)**	0.2677 (6.3026)	29.0892 (3.8581)**
Observations	495	535	590	640
R-squared	0.89	0.89	0.90	0.90
Pre-period start	1995	1990	1980	1970

Notes: Regressions of log album supply indices on a time trend (“year”) and a divergent post-1999 trend. Regressions are weighted by the number of works included in each index, divided by the number of years it covers. Standard errors in parentheses. \* significant at 5% level; \*\* significant at 1% level

Table 6: Album Supply following Napster and iTunes Relative to Songs

	(1)	(2)	(3)
album x post-1999	-0.0054 (0.0771)		-0.0455 (0.0799)
album x post-2003		0.1008 (0.0564)	0.1097 (0.0586)
Constant	2.2969 (0.0891)**	2.2957 (0.0888)**	2.2969 (0.0889)**
Observations	923	923	923
Number of indices	88	88	88

Notes: Regression of log supply indices on indicators for albums post 1999 and albums post-2003. Standard errors in parentheses. All regressions include flexible time dummies that are common to albums and songs. Regressions are weighted by the number of works included in each index, divided by the number of years it covers. \* significant at 5% level; \*\* significant at 1% level.

source	Era covered	Date released	reference	origin	songs?
Zagat 1000 Top Albums of All Time	-2003 (partial)	Sep 2003	<i>Zagatsurvey Music Guide: 1,000 Top Albums of All Time</i> (Zagat Survey: Music Guide) 2003	USA	0
Pitchfork “Top 200 Albums of the 2000s”	2000-09 (partial)	Sep-09	<a href="http://pitchfork.com/features/staff-lists/7706-the-top-200-albums-of-the-2000s-200-151/">http://pitchfork.com/features/staff-lists/7706-the-top-200-albums-of-the-2000s-200-151/</a>	USA	0
Pitchfork “Top 500 Tracks of the 2000s”	2000-09 (partial)	Aug-09	<a href="http://pitchfork.com/features/staff-lists/7685-the-top-500-tracks-of-the-2000s-500-201/">http://pitchfork.com/features/staff-lists/7685-the-top-500-tracks-of-the-2000s-500-201/</a>	USA	1
Pitchfork “Top 100 Albums of the 1990s”	1990-1999	Nov-03	<a href="http://pitchfork.com/features/staff-lists/5923-top-100-albums-of-the-1990s/">http://pitchfork.com/features/staff-lists/5923-top-100-albums-of-the-1990s/</a>	USA	0
Pitchfork “Top 100 Albums of the 1990s”	1990-1999	Oct-99	<a href="http://web.archive.org/web/20010616215501/http://pitchforkmedia.com/top/90s/">http://web.archive.org/web/20010616215501/http://pitchforkmedia.com/top/90s/</a>	USA	0
NME Top 100 Greatest Albums of the Decade	2000-09 (partial)	Nov-09	<a href="http://www.nme.com/list/albums-of-the-decade/158049/page/1">http://www.nme.com/list/albums-of-the-decade/158049/page/1</a>	UK	0
Metacritic All Time High Scores (top 50 pages)	2001-2010 (partial)	Downloaded October 8-15, 2010	<a href="http://www.metacritic.com/browse/albums/score/metascore/all?sort=desc">http://www.metacritic.com/browse/albums/score/metascore/all?sort=desc</a>	USA	0
Rolling Stone’s 500 Greatest Albums of All Time	-2004 (partial)	April 2004	<a href="http://www.rollingstone.com/music/lists/5702/31963">http://www.rollingstone.com/music/lists/5702/31963</a>	USA	0
SPIN Magazine “125 Best Albums of the Past 25 Years”	1985-2010 (partial)	Jul-10	<a href="http://www.spin.com/spin25/125-best-albums-past-25-years">http://www.spin.com/spin25/125-best-albums-past-25-years</a>	USA	0
A.V. Club Staff, “The best music of the decade.” (50 albums)	2000-2009 (partial)	Nov-09	<a href="http://www.avclub.com/articles/the-best-music-of-the-decade,35540/">http://www.avclub.com/articles/the-best-music-of-the-decade,35540/</a>	USA	0
Paste Magazine, “The 50 Best Albums of the Decade (2000-	2000-2009 (partial)	Nov-09	<a href="http://www.pastemagazine.com/blogs/lists/2009/11/the-best-albums-of-the-decade.html">http://www.pastemagazine.com/blogs/lists/2009/11/the-best-albums-of-the-decade.html</a>	USA	0

source	Era covered	Date released	reference	origin	songs?
2009)”)					
BestEver	All time (top rated albums)	As of October 10, 2010	<a href="http://www.besteveralbums.com/topratedstats.php?o=album">http://www.besteveralbums.com/topratedstats.php?o=album</a>		0
One Thirty BPM Top 100 albums of the 2000s	2000-2009	Feb-10	<a href="http://onethirtybpm.com/2010/02/15/the-top-100-albums-of-the-2000s/">http://onethirtybpm.com/2010/02/15/the-top-100-albums-of-the-2000s/</a>	USA	0
Rate My Music top 1000 albums	All time	As of Oct 19, 2010	<a href="http://rateyourmusic.com/">http://rateyourmusic.com/</a>		0
Pitchfork “Top 100 Albums of the 1980s”	1980-1989	20-Nov-02	<a href="http://pitchfork.com/features/staff-lists/5882-top-100-albums-of-the-1980s/">http://pitchfork.com/features/staff-lists/5882-top-100-albums-of-the-1980s/</a>	USA	0
Acclaimed Music Singles (top 3000)	-2008	Nov-08	<a href="http://www.acclaimedmusic.net/">http://www.acclaimedmusic.net/</a>		1
Acclaimed Music Albums (top 3000)	-2009	Nov-09	<a href="http://www.acclaimedmusic.net/">http://www.acclaimedmusic.net/</a>		0
Spinner Top 50 Songs of the 2000s	2000-2009	24-Nov-09	<a href="http://www.spinner.com/2009/11/24/best-songs-2000s/">http://www.spinner.com/2009/11/24/best-songs-2000s/</a>	Canada	1
One Thirty BPM Top 100 Tracks of the 2000s	2000-2009	15-Feb-10	<a href="http://onethirtybpm.com/2010/02/15/the-top-100-tracks-of-the-2000s/">http://onethirtybpm.com/2010/02/15/the-top-100-tracks-of-the-2000s/</a>	USA	1
NME Top 100 Tracks of the Decade	2000-2009	Nov-09	<a href="http://www.nme.com/list/tracks-of-the-decade/158050">http://www.nme.com/list/tracks-of-the-decade/158050</a>	UK	1
Blender 500 Greatest Songs Since You Were Born	1980-2005	Sept. 2005	<a href="http://www.blender.com/lists/68126/500-greatest-songs-since-you-were-born.html">http://www.blender.com/lists/68126/500-greatest-songs-since-you-were-born.html</a>	USA	1
Q	2000-2009		<a href="http://www.qthemusic.com">www.qthemusic.com</a>	UK	0
FACT	2000-2009		<a href="http://factmag.co.uk">factmag.co.uk</a>	UK	0
Gigwise	2000-2009		<a href="http://gigwise.com">gigwise.com</a>	UK	0
Gigwise	2000-2009		<a href="http://gigwise.com">gigwise.com</a>	UK	1
Guardian, The	2000-2009		<a href="http://guardian.co.uk">guardian.co.uk</a>	UK	1

source	Era covered	Date released	reference	origin	songs?
The Line of Best Fit	2000-2009		lineofbestfit.com	UK	0
Mixmag	2000-2009		mixmag.net	UK	0
musicOMH	2000-2009		musicomh.com	UK	0
Resident Advisor	2000-2009		www.residentadvisor.net	UK	0
Resident Advisor	2000-2009		www.residentadvisor.net	UK	1
Rock's Back Pages	2000-2009		www.rocksbackpages.com	UK	0
The Guardian	2000-2009		guardian.co.uk	UK	0
The Sun	2000-2009		www.thesun.co.uk	UK	0
The Sunday Times	2000-2009		sunday-times.co.uk	UK	0
The Times	2000-2009		timesonline.co.uk	UK	0
The Word	2000-2009		www.wordmagazine.co.uk	UK	0
Times, The	2000-2009		timesonline.co.uk	UK	1
Uncut	2000-2009		Uncut.co.uk	UK	0
Virgin Media	2000-2009		virginmedia.com	UK	0
Word, The	2000-2009		www.wordmagazine.co.uk	UK	1
BET	2000-2009		bet.com	USA	0
MSN.com	2000-2009		msn.com	USA	0
American Songwriter	2000-2009		americansongwriter.com	USA	0
Austin Town Hall	2000-2009		austintownhall.com	USA	0
BetterPropaganda	2000-2009		betterpropaganda.com	USA	0
Billboard	2000-2009		billboard.com	USA	0
Boom Box, The	2000-2009		theboombox.com	USA	1
Boot, The	2000-2009		www.theboot.com	USA	1
CokeMachineGlow	2000-2009		Cokemachineglow.com	USA	0
Complex	2000-2009		complex.com	USA	0
Complex	2000-2009		complex.com	USA	1

source	Era covered	Date released	reference	origin	songs?
Consequence of Sound	2000-2009		consequenceofsound.net	USA	0
Consequence of Sound	2000-2009		consequenceofsound.net	USA	1
Creative Loafing	2000-2009		creativeloafing.com	USA	0
Daily Californian	2000-2009		dailycal.org	USA	0
Decibel	2000-2009		decibelmagazine.com	USA	0
Delusions of Adequacy	2000-2009		Delusionsofadequacy.com	USA	0
eMusic	2000-2009		emusic.com	USA	0
Entertainment Weekly	2000-2009		ew.com	USA	0
Ghostly	2000-2009		ghostly.com	USA	0
Glide	2000-2009		glidemagazine.com	USA	0
HipHopDX	2000-2009		hiphopdx.com	USA	0
Kitsap Sun	2000-2009		kitsapsun.com	USA	0
LostAtSea	2000-2009		www.lostatsea.net	USA	0
Lost At Sea	2000-2009		www.lostatsea.net	USA	1
Metromix Denver	2000-2009			USA	0
Noise Creep	2000-2009		www.noisecreep.com	USA	1
National Public Radio	2000-2009		npr.org	USA	0
NPR	2000-2009		npr.org	USA	1
Popdose	2000-2009		popdose.com	USA	0
Popdose	2000-2009		popdose.com	USA	1
Rhapsody	2000-2009		rhapsody.com	USA	0
Rhapsody	2000-2009		rhapsody.com	USA	1
Rolling Stone	2000-2009		rollingstone.com	USA	1
Rolling Stone	2000-2009		rollingstone.com	USA	0

source	Era covered	Date released	reference	origin	songs?
Slant	2000-2009		slantmagazine.com	USA	0
Slant	2000-2009		slantmagazine.com	USA	1
Stylus	2000-2009		thestylusdecade.com	USA	1
Stylus Decade	2000-2009		thestylusdecade.com	USA	0
The Boombox	2000-2009		theboombox.com	USA	0
Tiny Mix Tapes	2000-2009		tinymixtapes.com	USA	0
Treble	2000-2009		Treblezine.com	USA	0
Treble	2000-2009		Treblezine.com	USA	1
Under the Radar	2000-2009		Undertheradarmag.com	USA	0
Irish Times	2000-2009		www.irishtimes.com	Ireland	0
State	2000-2009		www.state.ie	Ireland	0
NOW	2000-2009		nowmusicforums.com	Canada	0
Spinner	2000-2009		spinner.com	Canada	0