The song remains the same? Technological change and positioning in the recorded music industry

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Abstract

Technological change in the recorded music industry has spurred changes – file sharing, unbundling singles from albums, and streaming – that have eroded firms' abilities to generate revenues. Other technological changes have reduced the costs of production, distribution, and promotion, as well as the search for talent. These changes have influenced the strategic positioning of major and independent record labels. We examine the new music releases of major and independent labels before and after the technological change, using a differences-in-differences design and unique data on over 63,000 albums released in the US between 1990 and 2010. We find first, that major labels increasingly choose artists that have been previously successful, both on the same label and on other labels; second, that music releases increase for independent labels but decrease for the majors; and third, that this selective approach appears to work, as a growing share of major label releases achieve commercial success on the Billboard listings. However, despite growing relative success, since overall revenue is declining in the industry, US revenues for major labels fall, while the revenues of independent labels are stable. Our results support the idea that major labels deploy their high-cost capabilities in a narrowing segment of the market, releasing successful artists that have broad market appeal and high revenue, while independents adopt lower cost approaches, pursuing more music releases for smaller, lower revenue audiences. Thus, pre-change strategic positions appear to influence the labels' responses to – and adoption of – the technological change, resulting in even more heterogeneous positions post-change.

Introduction

Technological change has brought fundamental challenges, as well as opportunities, to the recorded music industry. Beginning with the advent of MP3 technology in the late 1990s, these changes have included unpaid music file sharing (e.g. Napster), legal downloading via iTunes and other services, a shift to purchasing singles in lieu of entire albums, and most recently, music streaming via services such as Spotify, Deezer, and YouTube. The changes have eroded industry revenue as firms are unable to capture value in the traditional ways, such as selling entire physical music albums. Recorded music revenue has fallen by over half since Napster's appearance in 1999 (Aguiar and Waldfogel, 2015), making it more difficult for record labels to fund the release of new music using traditional high-cost modes of production, distribution, and promotion: pressing music onto physical media, transporting records to retail locations, and promoting the new works on terrestrial radio. But at the same time, digitization in the music industry has also made possible new, lower cost approaches for music industry activities.

The music industry has traditionally been characterized by two types of organizations that occupy two different strategic positions in the market: the "major" record labels, controlled by a handful of media firms (Warner, Universal, Sony, etc.), and a large number of "independent" labels. Major record labels specialize in releasing music targeted at large groups of consumers. The major record labels have traditionally utilized high-cost, high-promotion approaches aimed at commercializing music products with broad expected market appeal and high revenue potential. The majors have dominated the industry, releasing products that account for the vast majority of industry revenue. In contrast, independent record labels occupy a different strategic position. These labels employ lower-cost approaches, for example forgoing attempts to obtain radio airplay, allowing them to release products expected to appeal to smaller, niche groups of consumers. While independent labels release far more records than the majors, independent releases collectively account for a small share of industry revenue (traditionally about 10-15 percent).

Although economists have recently begun to study technological change, 'digitization,' and 'digital disintermediation' in the music industry (e.g. Liebowitz, 2006; Waldfogel 2012a; 2012b; Aguiar and

Waldfogel, 2015; Smith and Telang, 2010; Zentner, 2006), such research has not explored questions at the organization level, i.e. the strategy implications for organizations faced with these technological changes.

Our study explores how these different types of music labels – with different positions and resources prior to the technological changes – respond to the technological changes in the music industry. We ask how the positioning of the different types of labels – as reflected in the different sizes and types of audiences they target – as well as the outcomes differ for major label versus independent label organizations as technological change unfolds. We rely on a unique, extensive set of data on over 63,000 new US music releases between 1990 and 2010. Our data include the music releases (i.e. the new products) of record labels and artists, as well as the subsequent success of these releases as measured by the Billboard top 50 and top 200 sales rankings. We document how the technological change alters the different labels' strategic positioning by tracking the extent to which record labels' new releases entail leveraging already-known, previously successful artists (versus discovery of new-to-the-world artists), and how this changes over time, before and after the technological changes.

Technological change has reduced the cost of producing, distributing, and even promoting recordings. In principle, this could allow both sorts of organizations to alter their positions to similarly focus on products targeted at small audiences. Instead, we find that major and independent record labels respond in markedly different ways to the same technological changes. The independent record labels, which had already staked out a low-cost strategy to release products for niche audiences prior to the change, appear to adopt the cost reductions made possible by new technologies. The number of new music products released by independent labels increases markedly, both due to increases in the music releases by existing independents as well as entry by new independents spurred by lowered barriers to entry.

By contrast, major record labels dramatically increase their selectivity, i.e. identifying and releasing new music products from already-successful talent, including both the already-proven artists previously released on their own labels as well as artists with prior success on other labels. We also find a

corresponding decrease over time in the number of music products released by major labels. Further, we find that as the major labels become even more selective in releasing music from very high revenue artists, the "success" (the likelihood of being listed on the Billboard top 50 or top 200 charts) of their new music releases also improves. These findings are consistent with our hypotheses that the major labels seek to preserve the value of their existing resources and capabilities in a narrowing segment comprising the most the promising artists with the widest market appeal, both because this is where their interrelated capabilities are likely to retain the greatest value, and also because doing so reduces their cost of discovery and increases sales certainty in the face of revenue pressures. Thus, we document that fundamentally different responses to the technological changes by these heterogeneous entities spur them toward even more heterogeneous positions post-change.

Our study and findings make important contributions to research. First, our study contributes to research on positioning, a central topic in strategy (e.g. Porter, 1980; Rumelt, Schendel, and Teece, 1994). Past research has considered the drivers and implications of firms' different positions in product/market space, technological space, and geographic space (e.g. Semadeni, 2006; Stuart and Podolny, 1996; de Figeuredo and Silverman, 2007) as well as the influence of competition on changes in position (Wang and Shaver, 2013). However, this prior work has not studied how a major technological change in an industry influences the evolution of firms' positions. Our study takes a first step in showing how organizations' responses to the technological changes are likely influenced by differences in their pre-change positions and resources, and how these positions evolve following major technological changes, such that there is even greater divergence following the change. We utilize a rich longitudinal dataset and robust empirical methods to show the influences of the same technological changes on very different evolutionary trajectories for different types of organization, via how they select the talent for their new products. These paths reinforce pre-change positions and give rise to even more marked differences in eventual positions.

Our second important contribution is to the research on technological change. While a rich body of prior work in management and strategy has explored the challenges of technological change for

organizations (e.g. Tushman and Anderson, 1986; Utterback, 1994; Sull et al, 1997; Henderson and Clark, 1990; Christensen and Bower, 1996; Gilbert, 2005), this prior research has largely focused on uncovering factors that impede incumbents from responding successfully, for example, in cases of competence destroying technological changes (Tushman and Anderson, 1986), or due to managerial cognition (Tripsas and Gavetti, 2000); organizational structures and communication channels (Henderson and Clark, 1990); and pressures from securities analysts (Benner, 2010; Benner and Ranganathan, 2012). In such studies the focus is often on incumbents as a homogeneous group, and it is typically entrants from outside the industry – either new entrants or diversifying established firms – that are viewed as more capable of responding to the opportunities offered by the new technology. Here, we study two types of incumbents in the same industry, where heterogeneity in both their pre-change positions and resources is clear ex ante. Although we might expect a technological change to generally affect industry incumbents in similar ways, spurring greater convergence in their positions, in our study the two different types of incumbent organizations respond in markedly different ways to the challenges and opportunities created by the same technological changes. While some research has studied firms' different responses to the same technological change (e.g. Benner and Tripsas, 2012; Adner and Snow, 2010), these studies have not focused on how differences in pre-change strategic positions and capabilities influence the evolution of positions in the face of a technological change.

Our work also makes an important methodological contribution. Much of the work on how firms respond to new technologies has relied on case studies of single organizations (Tripsas and Gavetti, 2000), or on data from a small number of incumbent firms in an industry or a few industries faced with technological change (Tripsas, 1997; Benner, 2010; Henderson and Clark, 1990; Tushman and Anderson, 1986). While these studies provide rich, in-depth insights into the dynamics of incumbent firms faced with technological change, their designs do not allow for causal attribution. Methodologically, our robust, large sample longitudinal design on the music products released by record labels over 20 years and our differences-in-differences design, before and after a technological change makes an important empirical contribution to strategy research in both positioning and technological change.

Empirical context: Technological change in the music industry

Our empirical context is the music industry, spanning 20 years from 1990 to 2010, during a period of radical technological change that has dramatically influenced both industry revenues and the costs of industry activities. To understand the influence of the technological changes on the industry –specifically the positioning of its participants – we first describe the traditional ways in which the industry's activities have been undertaken. We then describe the changes in these activities spurred by technological change.

The first major activity that record labels have traditionally undertaken is the 'discovery' of new artists. Many would-be artists seek to make their music available to consumers, for example, by submitting "demo tapes" to music labels.[1] These potential music products differ substantially in both their ex ante promise (how broadly appealing it seems that they might be if they were produced) as well as their ex post success (how successful they turn out to be, even holding constant how promising they seem at the outset).[2] Music is an "experience good," such that consumers generally cannot determine whether they like it until they have used it – e.g. listened to an album or song – repeatedly. The difficulty that consumers have determining whether they like new music creates challenges for record labels, which have difficulty predicting which of their potential projects would be successful with consumers. That is, investments in music products – particularly those by new artists but even those from established artists – are risky. These features of music stemming from the nature of the product affect many of the activities involved in bringing music to market.

Traditionally, a low percentage of the recorded material by traditional record labels has been successful, suggested by the industry analyst's comment that "perhaps as little as 10 percent of new material must make a profit large enough to offset losses on the majority of releases..." (Vogel, 2007). Record labels have therefore traditionally produced much more material than might actually succeed, and the vast majority of albums and records don't cover their costs (Caves, 2000). Thus, the traditional

[1] See Caves (2000) and Vogel (2007) for descriptions of the music industry.
[2] Aguiar and Waldfogel (2014) present evidence on the distinction between ex ante promise and the ex post success of new music products. A fairly inclusive set of variables can explain less than 40 percent of the variation in commercial success across the tracks released in the US in 2011.

discovery process in the music industry is expensive, analogous to taking 'draws from an urn.' Even major record labels have faced this problem: while they have focused on artists with substantial commercial prospects, the prospects are realized for only a fraction of releases.

Beyond the discovery stage, making music available to consumers has typically required a series of costly activities. First, music is recorded and produced, which traditionally has required both expensive recording equipment as well as skilled labor. Once a master copy is recorded, it is physically produced, i.e. pressed onto some physical medium such as vinyl or, since about 1985, compact disc. Second, physical products have required physical distribution. This, in turn, entails two main activities: physical products needed to be transported from manufacturing facilities to warehouses and then to retail stores, and prior to this point, producers also had to convince retailers to carry their releases. A typical physical store in 1990 carried many fewer than the 30,000 albums per year released in the industry,[3] and the majority of recordings were therefore not available in most retail outlets. The transitory nature of demand for most successful popular music raised the cost of distribution. Because records needed to be available near consumers during the short window of possible consumer interest in a new album, producers needed to ensure that albums would be in stock in many locations. And because of the difficulty in predicting which releases would be successful, producers needed to undertake the costly step of making many new releases widely available, even though most would not become popular.

Finally, promotion has typically been expensive. Again, because music is an experience good, producers find it valuable to expose listeners to their new music. The chief means of new music promotion had long been through radio. As Vogel (2007) and Caves (2000) emphasize, the U.S. recording industry has traditionally produced far more new music than can be played on the radio. Hence there have been strong incentives for 'payola,' i.e. bribes from producers to radio stations or their employees to get particular songs played on the radio. As Caves (2000) describes, even after payola was

[3]According to Wired.com, a Tower Records location stocked 60,000 titles, while a Wal-Mart stocked 5,000. See http://www.longtail.com/the_long_tail/2005/07/americas_record.html .

explicitly outlawed, its analog continued to function, such that in 1985, the recording industry was paying radio stations $60-$80 million for airtime at a "time when its pretax profits were at most $200 million."[4]

Thus, for the major recording labels, success in the recorded music industry traditionally required a set of expensive and interrelated capabilities, including: 1) discovering talent/signing new artists, 2) producing albums, both artistically and physically, 3) arranging for physical distribution through retail outlets, and 4) arranging for promotion of music, generally on radio, but also through live concert performances. By 2000, music production was concentrated in four large media conglomerate firms that operated the major record labels.

Alongside the majors were independent labels unaffiliated with major media firms. While they too selected from the pool of would-be artists, their production, distribution, and promotion activities typically operated on a smaller scale and at lower costs than the majors. Independent music was rarely promoted on terrestrial radio (Thomson 2009).[5] Consequently, independent record labels collectively released a large number of albums with modest commercial prospects, while major labels were the outlets of choice for artists with more substantial commercial appeal (Kalmar, 2002).

Prior to 1999, these industry activities took place in an environment in which recorded music products were protected by a combination of law and technology, i.e. the 'appropriability regime' (Teece, 1986). Under copyright law, the labels producing particular albums had exclusive rights to market these works. Anyone selling copies of the works without agreement with the rights holders would be violating the rights holders' copyrights. Perhaps equally important, copying – while feasible – was inconvenient relative to the cost of purchasing legal copies. Prior to diffusion of the CD, consumers could copy the music on vinyl recordings onto cassette tapes; but even first-generation copies had poor sound quality. With the spread of writeable CD drives in the late 1980s, consumers could make perfect copies of CDs, but the process was cumbersome and required some technical sophistication. These frictions, along with

[4] See page 292 in Caves (2000).
[5] See http://www.futureofmusic.org/sites/default/files/FMCNYSplaylisttrackingstudy.pdf .

copyright law, were sufficient to prevent large-scale music file sharing (and allow music labels to capture the revenue from their releases) in most advanced economies.

Technological Changes in Music

The advent of MP3 technology in the late 1990s along with the diffusion of the Internet triggered several important changes in the music industry. First, starting with the appearance of Napster in 1999, consumers obtained the ability to access and download high-quality digital recordings via peer-to-peer file sharing without payment to the rights holders. The ease of transferring and downloading music without payment fundamentally weakened copyright protection and the recorded music industry's appropriability regime, making it much more difficult for record companies to protect their content. Since then, while illegal file sharing has given way to legal sales via iTunes and other digital platforms, new digital revenue has not offset declining physical revenue, giving rise to collapse of revenue in the recorded music industry (e.g. Oberholzer-Gee and Strumpf, 2007; Rob and Waldfogel, 2006; Liebowitz, 2006; Zentner, 2006; Blackburn, 2004). Thus, the technological changes have heightened the difficulty for the record labels, both majors and independents, to generate and capture the traditional levels of revenue from their music products. This, in turn, creates challenges in funding the large investments to discover 'new to the world' talent in the traditional ways.

But technological changes have simultaneously offered the potential for lower cost ways to produce, distribute, and promote music. Where traditional sound recordings required costly studio equipment, an artist can now create a high-fidelity recording using inexpensive and widely available computers and software (e.g. a Mac with Garageband). The diffusion of the Internet – and digital retailing – offers an inexpensive way to distribute music (Bourreau, et al, 2012). Labels need not produce physical copies, nor do they need to make them ubiquitously available for consumers in the event they become popular. Finally, other aspects of digitization can reduce the costs of promotion. Internet radio, including Pandora, Last.fm, rdio, Spotify, and others offer lower cost alternatives to terrestrial radio in acquainting consumers with new music. Internet radio stations broadcast a wider variety of music than terrestrial stations, allowing promotion for many more artists. A growing coterie of reviewers makes their views

available online. Consumers have access to information on far more new music than they encountered through traditional promotional machinery (Waldfogel 2012a).

Knopper (2009: 246) describes the process and the changes to the process triggered by the new technologies:

> An artist who wanted to make a record needed studio time – and that cost money, which meant a sizable loan from the label. An artist who wanted to get a single onto the 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 major labels' 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 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? Artists can follow Radiohead's example and simply distribute the music essentially free online.

Waldfogel (2012a) further provides the example of Arcade Fire's album The Suburbs, which won the 2011 Grammy award for best album, as a music release that attained a high level of both commercial and critical success with little traditional radio airplay. The album was released by the independent label Merge Records, and although the album received critical acclaim (as had their previous albums, Funeral in 2004, and Neon Bible, in 2007), it received little radio airplay. The album received substantial Internet radio airplay, however, and the song "Ready to Start" had over 40,000 weekly listeners at last.fm in 2011. The album won the Grammy for best album and was subsequently certified Gold by the Recording Industry Association of America (RIAA), indicating sales of 0.5 million by October, 2011.

HYPOTHESIS DEVELOPMENT

The responses of major versus independent label organizations

Our interest is in how the different types of record label organizations (majors versus independents) respond to these technological changes. Specifically, we are interested in how the changes in revenue and costs in the industry, triggered by technology change, affect the positioning of, and outcomes for, these different types of record labels. We study the nature of their music product releases, specifically the

extent to which new products involve greater selectivity in choosing already-successful artists – in contrast to discovering 'new to the world' artists – and the outcomes associated with these behaviors.

The industry technological changes threaten to destroy the value of the majors' complementary assets in production, distribution, and promotion. These activities can now be pursued through much lower cost approaches, and the technological changes have also made it increasingly difficult to generate revenue to cover the high costs of these capabilities. But the major labels' competencies are also likely to retain their value for the most promising recording artists with the broadest market appeal and the highest potential revenue. That is, a strategy of high-cost promotion, including radio airplay and an expensive choice of ubiquitous availability of physical product in retail stores, continues to have high economic returns for recording artists with wide market appeal. While activities such as traditional radio airplay are expensive and therefore a risky investment in the case of an artist who may have little appeal, it is also unlikely that lower-cost approaches, such as discovery via YouTube or Internet radio are the most effective ways to produce and promote the products with strong commercial prospects. Taylor Swift would prefer to have her music releases distributed and promoted in these ways rather than via Spotify.[6] Thus, the major labels' complementary assets are expensive but continue to be valuable in the industry post-change, albeit possibly for a narrowing set of artists with very broad market appeal and the highest revenue potential.

At the same time, the decline in revenue for music products constrains the expenditures that major labels are able to make on what has traditionally been costly and risky 'discovery,' i.e. finding 'new-to-the-world' artists. Greater selectivity, i.e. increasing the extent to which they leverage prior success, reduces the costs of discovery and increases the certainty of revenues. Major label organizations are therefore likely to become more selective, finding ways to lower the risk and costs inherent in discovering

[6] See Hannah Ellis-Petersen, Taylor Swift takes a stand over Spotify music royalties, The Guardian, November 5, 2014 (http://www.theguardian.com/music/2014/nov/04/taylor-swift-spotify-streaming-album-sales-snub.

new talent but continuing to identify the artists with broad appeal, to which they can most appropriately apply their set of interdependent capabilities. We therefore expect that the major labels will increase their selectivity in choosing artists for music releases, such that after the reduction in appropriable revenue, they will release more music from already-proven artists, i.e. a narrower set of more promising music releases than in the past. This greater selectivity, in turn, likely increases revenue, helping to realize and maintain the value of these complementary assets. At the same time, as major record labels become increasingly selective, focusing on the most promising artists and shifting away from the costly activities and risk associated with the discovery of new to the world artists, they also likely release fewer new music products.

Our arguments are consistent with prior work in strategy showing that extant capabilities and complementary assets can influence firms' choices about which technologies to pursue, how to enter markets, and specific choices of product features and designs, as such decisions are perceived in light of existing competencies (e.g. Wu, Wan, and Levinthal, 2014; Tripsas and Gavetti, 2000). Here, organizations with traditionally high-cost strategic positions become more selective, identifying the product markets with the highest revenue potential, where their existing set of competencies can be more profitably deployed and continue to create value even in the face of technological change.

Anecdotal evidence from our setting comports generally with these ideas, suggesting that in the recorded music industry, the expensive complementary assets held by the major labels are accompanied by a strong industry belief that high-cost production and promotion capabilities are indicative of 'professionalism,' while the lower cost approaches for these activities are indicative of 'amateurism' (see Lemann, 2006). Additional direct evidence from industry accounts suggests, in line with our arguments, that while the adoption of lower-cost industry activities would seem attractive, the major labels have not adopted the lower cost activities for bringing products to market. Even after the technological changes widely understood to have enabled low-cost entry, it appears that the major record labels continue to engage in their higher cost activities. As of 2012, the International Federation of the Phonographic Industry ("IFPI," the associated representing major record labels internationally) reported that major

record labels were spending $1 million per album to release work by a new artist and twice that for an established artist.[7] While the major labels' executives raise issues about lost revenue, they make no mention of reduced costs to produce music.

In contrast, independent labels have traditionally occupied the market position with lower costs, producing music releases from artists with narrower market appeal for specific niches of smaller audiences and more modest revenue prospects. While the revenue reductions could be expected to dampen releases for independent as well as major labels, all else equal, the cost reductions are substantial enough to outweigh negative effects on revenue for independent labels (Aguiar and Waldfogel, 2015). Cost reduction in relation to revenue allows the independent labels to move to more extreme versions of their former, low-cost positions. That is, independent labels can profitably release would-be artists aimed at even smaller audience niches and with more modest revenue prospects than in the past. We expect that such organizations, traditionally pursuing lower cost positions aimed at smaller niche audiences, will respond further to the technological change by utilizing the even lower cost approaches to industry activities facilitated by the technological change. Moreover, these reductions in the cost of industry activities further reduce barriers to entry, raising the potential for more (newer and even smaller) music producers to enter the market, with lower costs and the potential to produce music aimed at even smaller audiences with even lower revenue prospects. Thus, we would expect independent labels to rely on selectivity much less than major labels and continue and possibly increase their releases of new-to-the world artists. We therefore also expect changes in the number of music releases to diverge from major labels and increase rather than decrease. This increase comprises both an increase in the music releases of existing independent record labels, and the releases of new entrants.

The foregoing arguments suggest different responses to the technological change by major versus independent record labels:

> *Hypothesis 1: Subsequent to the technological change, music releases by the major record labels will increasingly leverage already-successful artists; this change for major labels will be larger than for independent labels.*

[7] http://www.ifpi.org/content/library/investing_in_music.pdf

Hypothesis 2: Subsequent to the technological change, major labels will be more likely to decrease music releases, while independent labels will be more likely to increase music releases.

Also, as suggested in our arguments above, we expect that the increase in leveraging already-successful artists, particularly for major labels, will involve both the releases of artists that were previously successful on the same label as well as artists that were previously successful on other record labels.

The outcomes for major versus independent labels

As the technological change and greater selectivity by major labels unfold, we would expect the success of their releases to also increase. As prior research suggests, traditionally about ten percent of new releases cover their costs (Caves, 2000). However, products also vary in the degree to which their appeal is predictable. Sequels to successful movies are less risky than new concepts, and novels by well-known authors (Tom Clancy, John Grisham) are less risky than first novels by unknown writers. Similarly, follow-up albums by already-successful artists are less risky than albums by untested artists. Thus, we expect the combination of organizational shifts to a focus on selection of talent with higher expected success combined with the greater predictability of success for the follow-on releases of these successful artists would result in improved revenue performance. Further, this also suggests that the lower bound of expected success for major label releases would rise, and thus, we would expect the current success of the major label's new releases to rise.[8]

Hypothesis 3: Subsequent to the technological change, the music releases of the major labels will be increasingly successful (and more successful than the releases of independent labels), i.e. they will have greater relative success in the Billboard top 200 or top 50.

DATA AND METHODS

Data Sources

Our data consist of 63,271 recorded music albums released in the US between 1990 and 2010, collected from Discogs.com. Because our focus is on new music releases, we exclude compilations and re-releases

[8] Because sales are falling overall, a qualified version of this prediction is that we expect higher relative success, such as a higher probability that new releases from major labels will appear in, say, the top 200 albums.

of already-released music. The Discogs data provide the artist name, album title, release year, and the name of the record label releasing the album. The Discogs data do not include sales measures for the albums. While album sales data exist – and the A.C. Nielsen Company is the main source – these data are prohibitively expensive. However, we were able to get a measure of relative album sales from both the Billboard 200 and the Billboard 50 – weekly rankings of the top 200 and top 50 albums, ranked by sales in the U.S. We collected these data for each week, from 1985 to 2010. We aggregated the Billboard data by year and recording artist (or group) to create a dataset with the annual number of listings on the Billboard 200 or Billboard top 50 for each artist who appears on these weekly rankings. We then created a mapping to match the artists between Discogs and the same artists' names in the Billboard rankings, providing us a dataset with ranking based sales information by artist-year. In some cases the mechanical exact mapping was not effective due to typos and other differences in artist names. In those cases, research assistants combined by hand as many artists as possible across the two databases. The Billboard ranking data also allow us to impute revenue. We discuss the calculation of our measures in more detail below.

Our study focus requires us to further classify record labels as major or independent. Because the Discogs data include 16,048 distinct labels, this is a difficult task to accomplish completely. However, using the label classification in Thomson (2009), as well as Wikipedia, we classified 481 labels as major.[9] These include smaller labels owned by the three major music conglomerates. We also classified 1,625 additional labels as independents. This leaves a large number of labels unclassified. These 'unknown' labels release an average of 2.6 albums per label over the period 1990-2010, in contrast with 9.5 for the classified independent labels and 25.5 for the classified major labels, thus they appear to be more like independent labels than major labels. As we describe below, we show our results comparing major labels first with the 'known' independent labels, and then with the larger category of 'non-majors,' which combines both known independents and unknown labels into one category. Moreover, we explore the

[9] See Same Old Song (http://futureofmusic.org/article/research/same-old-song).

sensitivity of our results to an alternative definition of "major" labels that classifies as majors, the 'unknown' labels with more than some threshold number of total releases. As we detail below, results are consistent.

The Discogs data include 63,721 albums (music product releases), while the Billboard data include certifications for 5,252 artists and 15,917 artist-years. We merge the Discogs and Billboard data and, for each year, include both a measure of past sales success for each artist (the number of Billboard chart listings an artist has had prior to the current year) and a measure of the sales success for the current music release (the number of Billboard chart listings for the focal music release in the current year). We use the measures of 'success' both to determine past success and thus an organization's use of talent that previously has been successful, and to determine current success, i.e. the relative performance outcomes for organizations' music releases. Thus, we develop measures of the extent to which a record label organization's releases are debuts of new-to-the-world artists versus the extent to which the organization's releases display increasing selectivity, i.e. building on previously established, successful artists. We are also able to calculate the relative success of the releases of the record label's albums in each year as a measure of outcomes.

Measures of Music Release Characteristics

We calculate the number of albums released by a music organization, by year and by label type (i.e. independent labels versus major labels). We classify releases according to whether the focal album is the artist's first release (i.e. first appearance in the dataset)[10] and if not, we also capture the extent to which the artist has prior Billboard chart appearances (i.e. previous success). Further, if an album is not an

[10] Some artists appear 'new to the world' in our dataset of music releases because this is their first solo album recorded on a label, but as artists, they may be not entirely new to the world. For example, some recording artists may have had successful releases as part of a previously successful band, although the focal release is their first solo recording. We conducted media searches to better understand how frequently artists might already be 'known' from prior music releases. Such occurrences are also instances of greater selectivity, suggesting that to the extent they occur, we are simply underestimating the extent to which record labels are leveraging previously successful artists.

artist's first appearance, we determine whether the album is a re-appearance for that artist on the same label, versus whether the artist is new to a label but not entirely new to the market.[11]

From these initial measures, we create organization/year measures of how selective an organization's new music releases are each year, as well as the performance outcomes for releases from the current year (from appearances on the weekly Billboard top 200 or Billboard top 50 rankings). Thus, we can calculate the level of past success of the artists an organization selects for its music releases, as well as the current success of those music releases, for years before and after the technological change.

We measure the extent to which record labels leverage previously-successful artists for their music releases within a year (i.e. they have previously appeared on the Billboard top 200 or Billboard top 50), in essence, the extent to which organizations are shifting away from 'discovery' of new to the world artists following the technological change. We further break this down, measuring the extent to which record labels leverage successful artists that have previously been released on the same label ("internal"), as well as the extent to which record labels leverage successful artists that have previously been released by other music labels ("external"), i.e. music releases for a label/year involving artists that have already been released on other labels, and previously appeared on the Billboard top 200 or Billboard top 50 under a different label.

Measures of outcomes

We measure the outcomes using data from the weekly Billboard top 200 and Billboard top 50 rankings. The number of weekly appearances in these rankings provides a relative measure of success based on US sales ranks. Our main measure of success is whether a current release appears in these sales rankings, but the ranking can also be used along with overall national sales trends to approximate patterns of sales quantities.

[11] We use Discogs data on an additional releases back to 1980 in order to calculate dates of artists' first releases and the first releases of albums on particular labels. Hence, we can mistakenly a post-1989 release as an artist or label debut only if the artist has had a decade-long hiatus.

The Billboard top 200 and top 50 are sales ranks, providing information on relative sales (i.e. that the n^{th} ranked album outsold the $(n+1)^{st}$), but not providing information on the absolute level of sales. While a general comparison of sales of major versus independent record labels can be carried out using sales ranking data (to test H3), it is also useful to create indices that reflect the overall levels in sales. Figure 1 shows the time pattern of US recorded music sales, 1989-2011 (in $2010). As the figure shows, sales rose steadily until 1999 and have since declined substantially.

We construct sales indices reflecting the time pattern of aggregate sales as follows: First, we distinguish between the sales level of music releases at different ranks. There is a robust research tradition of translating sales ranks into sales quantities using the following relationship: $q = Ar^B$, where q is the quantity sold and r is the sales rank. The parameter B reflects how quickly sales fall off at lower ranks (higher values of r). Studies generally find B to be in the neighborhood of -1, so that the sales of a particular album at rank *r* are proportional to (1/r).[12] Second, we need a value of A to reflect how particular ranks might map differently into sales across years. For this we use the data on the overall value of record sales in the US from the Recording Industry Association of America (RIAA) in Figure 1. We then construct indices of sales as $q_{ot} = S_t \sum_{i \in o} {}^{1}/_{r_{it}}$, where o refers to a record label organization, and S_t is sales in year t. From this we approximate the organization o's sales in year t as the sum of the reciprocal of its albums' weekly sales ranks, weighted by the real value of overall sales in that year. The absolute level of the resulting index is not equal to the albums' sales, but its time pattern will provide a reasonable approximation for the organization's time pattern of US music sales.[13]

Summing up, we can calculate the extent to which an organization's music releases entail new to the world, unproven talent, build on its own proven, successful artists from prior years, or build on proven successful artists that have been released on other labels in prior years. We are able to study these

[12] See Chevalier and Goolsbee (2003), Brynjolffson, Hu, and Smith (2003), and Ferreira and Waldfogel (2013).
[13] Our revenue estimates, based on the US Billboard rankings, do not include international revenue, online revenue, or other sources of revenue, such as live concerts. Connolly and Krueger (2006) and Mortimer, Nosko, and Sorenson (2012) provide evidence that live performance accounts for a growing amount of revenue and, given the declining revenues from recorded music, a growing share of musician revenue as well.

measures both before and after the technological changes. We are also able to measure the performance outcomes of these different strategies.

Methods

We test our hypotheses by examining how the share of a label's releases that are albums by artists with prior chart success (previously released either internally or externally), a label's numbers of releases, and the share of a label's releases that achieve Billboard chart success – vary over time with the technological change. The start of the reduction in revenue for firms in the industry is easily linked to the appearance of Napster in 1999, but other changes, such as the shift from purchases of albums to purchases of singles and cost reductions have unfolded over subsequent years, and other changes in the industry, such as the shift from vinyl to CDs precedes 1999. For example, digital distribution became viable with the appearance of the iTunes Music store in 2003. Online media spreading information about new music have also grown over time, as Pitchfork appeared in 1995, and Metacritic appeared in 1999.[14] Thus, there is no single date when cost reductions and other factors affecting revenue post-Napster appeared. Our main specifications distinguish between the period up to 1999 and the period since 1999, broadly denoting the period before the start of the revenue challenges in the recorded music industry and the period since. But in addition, we also explore specifications that measure the divergence between patterns in our main variables for major and independent labels beginning in 1990.

We run our analyses and display results in two ways. First, we present figures illustrating and contrasting the trends in releases, selectivity, and success over time and between major and independent labels. These figures provide the general evidence for the changes over time for major labels and independent labels respectively (for example, for increasing selectivity and numbers of music releases over time, for major labels as a group compared to independent labels as a group). Second, we show regression results from two versions of before-and-after models. We test some hypotheses with before-

[14] See http://en.wikipedia.org/wiki/Pitchfork_Media and http://en.wikipedia.org/wiki/Metacritic .

and-after models, by assessing whether the level of a variable of interest changes for a group of labels (majors or non-majors) following 1999 (marking the start of the revenue crisis in the industry):

$$y_{it} = \mu_i + \alpha\delta_{it}^{post} + \varepsilon_{it} ,$$

where y_{it} is an outcome of interest for label *i* in year *t*, δ_{it}^{post} is an indicator that is 0 until 1999 and 1 thereafter, μ_i is a label fixed effect, and ε_{it} is an error term. In this type of model, the coefficient α shows how an outcome at a particular group of labels (major or non-major) varies between the post-change period and the pre-change period.

We also estimate "difference in difference" models that assess how the outcome of interest varies for major labels versus its evolution at the non-major labels:

$$y_{it} = \mu_i + \theta_t + \alpha\delta_{it}^{post}\delta_i^{major} + \varepsilon_{it},$$

where variables are defined as described above, δ_i^{major} is an indicator for major labels, and θ_t is a time effect. (Note that we do not include δ_i^{major} alone as it is subsumed in the label fixed effects, nor do we include δ_{it}^{post} alone as it is subsumed in the year fixed effects). In this model α shows the extent to which the outcome variable at majors deviates from the time pattern at non-major labels. Thus, our research design employs a differences-in-difference approach, comparing changes in outcomes for majors vs others before and after the technological change, providing assurance that our results reflect the different organizations responses to the technological change, rather than time patterns common to both types of labels.

We augment this model in two ways to address possible concerns about a) the timing of the unfolding effects of the technological changes and b) the implications of choices in classifying our 'unknown' labels. First, to allow for more flexible timing of effects, we define a series of variables for post-1990 (which we term $\delta_{it}^{post-90}$, with other terms defined analogously), post-1995, post-2000, and post-2005, in addition to our post-1999 variable. The estimating equation is then:

$$y_{it} = \mu_i + \theta_t + \alpha^{90}\delta_{it}^{post-90}\delta_i^{major} + \alpha^{95}\delta_{it}^{post-95}\delta_i^{major} + \alpha^{00}\delta_{it}^{post-00}\delta_i^{major} + \alpha^{05}\delta_{it}^{post-05}\delta_i^{major} + \varepsilon_{it}.$$

The coefficient α^{90} then shows the divergence between the outcome (*y*) for major labels vs others for the period 1990-1995, relative to the period before 1990. The divergence for the period 1995-2000 is measured by$\alpha^{90} + \alpha^{95}$, and so on.

Second, to explore the implications of different classifications of the 'unknown' labels in our sample, we run additional analyses that consider unknowns with a high volume of releases as major labels rather than as independent labels. We use a new label type designation that combines major labels with the higher volume unknown labels (using various thresholds of numbers of releases, to display the robustness of our results). In these models we alter our designation of major record labels by replacing the variable δ_i^{major} with an alternative variable $\delta_i^{major'}$, which takes the value of 1 for labels that we can verify as 'major' labels, combined with the larger 'unknown' labels, i.e. those that have released more than some threshold number of albums during the study period.

RESULTS

Means and correlations are shown in Table 1. Hypothesis 1 predicts that major labels will increase their selectivity after the technological change, i.e. they will rely more on already-proven talent, and they will do so more than the independent labels. Figure 2 shows a comparison of the share of new music releases for major labels that entail previously successful artists with those from 'non-major' labels (the 'non-majors' in our figures are a combination of 'known independents' and other 'unknown' labels). As we note above, whether an artist was previously successful is measured by whether their albums have previously appeared on the weekly top 200 or top 50 in the Billboard album sales chart. The top two lines in Figure 2 show the percentage of new releases by major labels from artists that have previously been listed on the Billboard top 200 (dashed), and Billboard top 50 (solid). The two lines at the bottom of the chart display the same measures for releases by non-major labels; the dashed line represents non-major

label releases from artists previously listed on the Billboard top 200 while the solid line at the bottom of the graph shows non-major label releases from artists previously on the Billboard top 50.

As the chart shows, the share of releases from major labels during the 1990s from artists that had previous top-200 success averaged about 17 percent. From 2000 to 2010 the share rises fairly steadily to nearly 40 percent. (The pattern for the top-50 measure is similar but lower: about 12 percent in the 1990s, rising past 30 percent by 2010). The increase for major labels is substantial, a tripling in the share of new releases by already-successful artists, and therefore, a dramatic change in the extent to which the major record labels shift toward selecting on already-successful artists versus discovering new artists or releasing previously unsuccessful artists in their new releases. Further, it is clear that the absolute share of releases from already-successful artists is always higher at the major labels compared to non-major labels. While the share of already-successful artists also rises at non-majors, it remains low, in 2010 about one tenth the share at majors. Trends that are easily visible in Figure 2 are also statistically significant in regressions of a label's share of already-successful artists in their music releases on a post-1999 dummy. Selectivity increases by statistically significant amounts after 1999, for both major labels as well as independents and the larger group of 'unknowns.' As Figure 2 shows, the magnitude of the change is large for majors and small for other labels.

We directly test Hypothesis 1 using a differences-in-differences regression, comparing the selection of already-successful artists for music releases before and after the start of the technological changes that spurred the revenue challenges in the industry (1999), for major labels versus independent labels. Our results are shown in Table 2. All of the models in Table 2 control for record label fixed effects as well as year effects. Hence the effect of interest, the coefficient on post-'99 x major, shows the elevated level of selectivity for major labels following 1999, relative to the time pattern at the other labels. Column (1) shows results comparing major labels with identified independents, while column (2) shows the results of the comparison of majors with 'non-majors' (where non-majors combines independents and the 'unknown' labels). Both specifications show that that after 1999 (i.e. "post '99"), major labels significantly increased their leverage of already-successful artists, (i.e. that had previous music releases

listed on the Billboard top 200) relative to independent and non-major labels. The increase is large as well as statistically significant. Prior to 2000, the share of major-label releases by artists who had already achieved Billboard 200 success averaged about 0.15. Following 1999, the share rose by between 0.07 and 0.09 or about 50 percent. These results support Hypothesis 1. For space considerations, here and in the rest of the paper, we have shown only the results using the Billboard top 200. Our results are all consistent when using the Billboard top 50 as the measure of prior success, although the absolute magnitudes are perforce smaller for measures related to the top 50 rather than the top 200 (because fewer releases achieve top 50 than top 200 rankings).

Columns (3) and (4) in Table 2 show results from our analyses that allow for flexible timing rather than focusing simply on before and after 1999. We find no divergence in the selectivity by major labels compared to other labels in the 1990-1995 period, a 4-5 percentage point divergence 1995-2000, an additional 3-4 points for 2000-2005, and an additional 7-9 percentage points after 2005. Thus, some of the divergence in selectivity occurs prior to 1999, but most occurs after. Finally, column (5) shows results using the major label dummy that treats major labels as the combination of both identified majors as well as releases on 'unknown' but high-volume labels (here, we include labels that have greater than 40 releases during the sample period). Results are very similar to those in column (2).[15]

Hypothesis 2 predicts that the number of music releases will rise at independent labels relative to major labels. Figure 3 shows the total number of albums released in the U.S. by year, for each of our three label types. The number of annual releases from identified major labels fluctuates year to year, but reaches a recent peak of 713 albums in 1998, the last year before Napster and the use of MP3 technology for file sharing. By 2007 major label releases had fallen to 484, 32 percent below the 1998 release level. Releases from known independent labels, as well as the unknown labels likely either existing independent labels or new entrants, rise sharply over the same period. Releases from known independents rise from

[15] We experimented with different cutoffs. Our basic result – the divergence between major labels and presumptive independent labels – disappears if we include all or even most of the unknown labels as majors. It is highly implausible, however, that all of our unknown labels are actually major labels, given their low volumes of releases.

239 in 1990 to 1,141 by 2007, while releases from smaller unknown labels rise from 551 to 2,611 over the same period. These results suggest that the increasing selectivity to offset dampened revenue brought about by the technological change has spurred a decrease in music releases at the major labels. At the same time, it appears that the lower costs to produce music also increased the number of albums released by the smaller independent labels. Again, using the before and after approach, we also tested the significance of the changes shown in Figure 3, and the results for changes in numbers of releases after 1999 are all significant at the <.01 level.

We test hypothesis 2 directly using a differences-in-differences model, assessing the number of music products released before and after the technological change, and for major labels versus independents. The results are shown in Table 3. Columns (1) and (2) examine aggregate releases by label type (e.g. major labels, independent labels) and year, using regressions of the log of the number of releases on a dummy denoting major labels as well as dummy for post-1999 interacted with the major label dummy – to allow us to assess the differences between majors and other types of record labels before and after 1999. Column (1) shows results comparing major label releases to independents, while column (2) shows the results for majors compared with non-majors, combining independents and unknowns. The coefficient of interest, on the interaction of post-1999 and the major label dummy is about -1.11 in both specifications, indicating that major labels decrease releases by 68 percent relative to other labels; and this is significant at <.01.[16]

Columns (3)-(7) in Table 3 use label-level data (rather than the total number of annual releases for, say, all major labels) and also incorporate record label fixed effects. Column (3) compares major labels with independents, while column (4) compares major labels with non-majors (i.e. the combination of independents and unknowns). Both specifications show a 35-45 percent reduction in major-label releases relative to other labels, and both are significant at <.01. The within-label decline in major label releases in (3) and (4) are smaller than the overall effects in (1) and (2), indicating that some of the divergence

[16] Note that $1-e^{-1.11} = 0.68$.

between major and independent label release volume is not from within existing independent labels, but instead operates through the entry of additional independent labels during this period.

Columns (5) and (6) replace the post-1999 variable in Table 3 with the sequence of time variables similar to our approach in the analysis in Table 2. The resulting significant coefficients on all of the variables show that the divergence between the music release volumes of major and independent labels begins prior to 1999 and grows fairly steadily over the period. This suggests that there was divergence in the number of music releases for major labels and other labels as early as the 1990 to 1995 period. Since major label releases continue to increase until 1998, this suggests the divergence that we observe in the earlier 1990-1995 period arises from increases in music releases from independent labels, and not from a decrease in music releases by major labels. In part, this divergence may be spurred by new entry in the industry. In Figure 4, we use our data to document entry of new record labels during this period, measured by the first appearance of a label. Entry of major labels is low and steady over the entire period 1990-2010, while entry of non-major labels rises steadily over the period, from about 200 entrants in 1990 to about 1,000 in 2005. It is clear from Figure 4 that growth in entry of non-major labels pre-dates Napster. Thus, although entry and music releases for independent labels begin to increase earlier, a greater divergence in the numbers of new music releases for majors and independent labels is triggered by decreases in major label releases after 1999.

Finally, in column (7) of Table 3, we show the results for the post-1999 x major interaction effect with the augmented major label variable (that includes the high-volume 'unknown' labels, i.e. those labels with more than 40 releases during the period). The resulting coefficient (-0.28) is a bit smaller than the analogous coefficient in (4) but still negative and significant at <.01. Thus, these results support Hypothesis 2, and suggest that our results are robust to classifying the larger 'unknowns' as major labels.

Figure 2 and Table 2, described above, document that major record labels increase their focus on already-successful artists, particularly after 1999. We further explore the specific sources of successful artists for the product releases by the major labels, to determine the extent to which new releases arise from leveraging successful artists who have previously been successful on the same record label

("internal") versus leveraging previously successful artists who have previously been successful with releases on other record labels ("external"). During the 1990s roughly three quarters of the majors' releases of already-successful artists were internal (i.e. their previous success occurred at the same label as the current release). Hence, the majors have traditionally relied on their own stables of artists for promising follow-up releases. Since then, as Figure 5 shows, a growing share of the majors' already-successful release are "external," meaning that the artists' previous success was on a different label.

Findings about subsequent outcomes

We documented above that both major labels and independents have increased their reliance on already-successful artists for new music releases, and that this increase is particularly dramatic for the major record labels. Our hypotheses suggest that reliance on already-successful artists arises from efforts to release music from artists with broad appeal that will benefit from – and also help retain the value of – the major labels' interrelated and expensive capabilities and complementary assets. Here we examine whether this approach is successful. But because the major labels (e.g. Sony, Universal) are owned by large conglomerates, it is unfortunately not possible to measure the profit performance of their record label businesses. Instead, we used two approaches to measure the outcomes of the changes triggered by the technological change. Our main test measures the success of current releases by the share of current releases achieving a ranking on the Billboard top 200 during the year of the release, and changes in this share for each record label over time. We also converted the Billboard rankings into estimates of revenue as we described above in our measures.

Hypothesis 3 predicts that the music releases of major labels will have greater likelihood of success over time after the technological change and that this increase in success will be greater than for independent labels. As Figure 6 shows, there is a growing likelihood over time that major labels' releases have current 'success,' here measured as the music release's ranking on the weekly Billboard 50 or 200 lists during the year the record is released. The share of music releases by the major labels that appear in the Billboard 200 rises from under 20 percent in the late 1990s to 50 percent by 2010. A comparison with

the music releases from other label types shows that the corresponding probabilities of success for non-major label releases are below 10 percent throughout the period.

We also directly tested Hypothesis 3 using our differences in differences specifications. Table 4 shows results with measures of the divergence between the current success rates of major and other label releases before and after the start of the technological changes. Columns (1) and (2) report the results of regressions of current success (the share of a label's releases in each year where the artist appears in the Billboard 200) on label dummies, year dummies, and the post-1999 dummy interacted with major label. Column (1) compares majors with identified independents, while column (2) compares majors with the non-majors, i.e. the combined independent labels and unknown labels. Both specifications show a large and statistically significant divergence in the major label success rate following 1999. After averaging about 0.2 prior to the 2000, the major label success rates rises by 0.08 to 0.11, or about 50 percent relative to the other label types, following 1999.

Columns (3) and (4) show the results that allow for flexible timing for the divergence between major labels and others. We see no divergence for 1990-1995. The divergence begins in the 1995-2000 period and continues to grow to the end of the sample. The largest growth occurs after 2005. Column (5) shows that the effect is also consistent when the high-volume unknown labels are classified as majors. The results support hypothesis 3.

It would be desirable to show impacts on a more tangible measure of performance success than whether a release is ranked among the best-selling. While we lack performance measures that we would ideally like to observe, such as profit, we can construct the index of revenue described above. Figure 7 presents indices of estimated revenue for major and non-major releases over time. Although the probability of 'success' is rising for major label music releases after 2000 (see Figure 6), because overall national sales are declining, our estimated major label sales measure in Figure 7 is also declining after 2000. Our index of revenue for the non-major labels, by contrast, is stable. Hence, while the major-label strategy of focusing increasingly on previously successful artists is successful at the level of the

individual music release (i.e. major label artists are more likely to be the top selling records that appear on the Billboard lists), major record labels account for a declining share of total US industry revenue.

Interestingly, the success rate of the major label's artist debuts (i.e. new to the world artists, or the first time an artist has been released on any of the record labels in our sample) measured by appearance of a major label's debut releases in the Billboard 200 has also risen during our study period. It stood around 10 percent prior to 2000 and has since risen past 30 percent. This supports the idea that major labels have been selecting a narrower set of more promising artists than in the past, which translates into greater success rates, and this applies even to the outcomes of their discovery of 'new-to-the-world' artists. It is possible that discovery grows more successful in this context as record labels are able to know more about some artists' prospects even prior to their first recordings. One such source of information is user response to artist content posted at YouTube.[17] To explore this further, we conducted media searches to understand how recording artists may have been 'discovered' to assess how many of the new to the world artists debuting on major labels in 2010 were discovered on YouTube. We have identified over a dozen other artists also discovered at YouTube around 2010.[18]

DISCUSSION

We study the influence of major technological changes that have occurred in the music industry, particularly since the advent of MP3 technology, and specifically how different types of music label organizations responded. Technological changes have spurred decreases in industry revenue, first through file sharing enabled by the technology, and later through iTunes, the unbundling of singles from albums, and most recently, music streaming and YouTube. The dramatic decline in industry revenue has made it difficult for major labels to discover new talent in traditional high-cost ways, where many artists

[17] It is well known that Justin Bieber was discovered at YouTube. See Lizzie Widdicombe. "Teen Titan: The man who made Justin Bieber." The New Yorker, September 3, 2012 (http://www.newyorker.com/magazine/2012/09/03/teen-titan).

[18] These artists include Zee Avi, Chiddy Bang, and Cee Lo Green.

are produced and only a small fraction are successful. At the same time, technological changes have also facilitated new, lower cost ways of conducting industry activities.

Our results reveal very different responses from the two types of heterogeneous organizations in the industry, major record labels, traditionally pursuing high cost activities to target and produce artists with wide appeal for large audiences, and independent labels, typically using lower-cost approaches and targeting smaller niche audiences with lower revenue potential. We find that major labels respond to the technological changes by shifting their efforts away from the discovery of new-to-the-world talent for their new music releases, toward a focus on leveraging previously successful artists, and they have done this significantly more than independent labels. This increased selectivity entails both greater leverage of the successful artists that have been released on their own labels as well as increasingly leveraging the artists with prior Billboard success on other labels. While in the past, major labels often released new music from their own roster of previously-released talent, the tendency to leverage artists that have been successful on the Billboard top 200 and top 50 lists has increased markedly since the technological changes in the industry. Our results show further that this greater selectivity coincides with an overall decline in the number of major label music releases after the start of the technological changes.

This persistence in deploying high cost complementary resources and capabilities by the major labels likely arises due to the continued value of incumbents' complementary assets specifically for the most promising, broadest market appeal, and therefore highest revenue segment of the market. The most promising artists that are leveraged by the major labels as they become increasingly selective are likely to benefit from – and demand – the higher cost distribution and promotion capabilities of the major labels. In turn, in the face of declining revenue, the usefulness and value of these interlinked traditional capabilities likely pushes the major labels to continue to select the types of predictably promising talent that will benefit from these relatively expensive and interrelated capabilities. Coinciding with the shift to focus on the most promising talent, major labels also increase the likelihood of success of each new music release, measured by the increasing tendency for their music releases to appear in the weekly Billboard

top 50 or top 200 rankings. However, our estimates of revenue associated with these increasing 'successes' suggest that overall US revenue continues to decline for the major labels.

In contrast, the independent record labels produce more music after the technological change. These findings are consistent with our arguments that the independent labels have adopted the lower cost approaches to industry activities, enabled by technological change, and are now able to cover the (now lower) costs to produce, distribute, and promote more music for even smaller, lower revenue potential audiences. Our results further show that the increases in new music releases arise not only from increases in releases by existing independents, but also from new entrants as the reduced costs of production, distribution, and promotion lower barriers to entry. Moreover, the reduction in music releases by major labels is consistent with our arguments that the majors have not adopted the lower cost approaches for industry activities and are instead continuing to deploy expensive interrelated resources and capabilities, now in the narrower segment of the market where they are likely to retain their value.

Thus, our results reveal how different types of firms with different pre-change positions and resources evolve differently in response to the technological changes, such that their positions are even more heterogeneous after the technological change. This may partly be due to the dramatic increase in new independent record label entrants (see Figure 4) into the low cost/small audience positions in the industry that has spurred major labels to move even further from the lower-cost end of the industry toward a narrower segment of artists with the broadest market appeal.

Our study makes important contributions to prior research in two areas. First, this work contributes to research on positioning, by showing how organizations' responses to the technological changes are likely influenced by differences in their pre-change positions (i.e. via products targeted to narrower versus broader audiences) and associated resources, and how these positions evolve following major technological changes in the music industry such that there is even greater divergence post-change. We utilize a rich dataset and robust empirical methods to show the influences of a technological change on very different evolutionary trajectories for different types of organizations – paths that reinforce pre-change positions and give rise to even more marked differences in position post-change.

Second, we contribute to research on technological change by showing how a major technological change spurs changes in positioning in an industry between heterogeneous types of incumbents faced with the technological changes. How technological change influences the subsequent positions of organizations has not been studied in prior work. Our robust longitudinal differences-in-differences design allow for interesting insights into how different incumbents with different resources respond to the major technological change in markedly different ways and subsequently evolve differently.

Finally, our work has implications more broadly for understanding how technological change can affect innovation in industries. Our findings suggest that with the technological changes in the music industry, a growing share of new-to-the-world innovation – here the 'discovery' of new artists – is shifting away from the larger major labels toward smaller independent labels. These findings echo dynamics in the pharmaceutical industry, as major pharmaceutical manufacturers move away from costly research in-house, instead commercializing the discoveries of biotech firms. However, the unfolding dynamics in the music industry differ in an important way. Innovation undertaken by biotech firms, while perhaps funded differently than pharmaceuticals, e.g. by venture capital rather than public equity markets, is still an extremely expensive endeavor. In the case of pharma, the innovation activities may have shifted away from the large, major firms, but costly capabilities and resources are still required. In our setting, the costs of innovating have been dramatically reduced. The dynamics in our setting are akin to other settings characterized by "open" innovation, where the locus of innovation is moving from large firms to a fringe of new participants external to firms, where technology has enabled active participation in the low-cost creation of new and potentially innovative products (Boudreau and Lakhani, 2013; Benner and Tushman, 2015).

Although our study has specifically focused on an important technological change and outcomes for organizations in the music industry, the findings from our rich set of data on new product introductions for multiple organizations in an industry are likely generalizable to other settings of technological change. The combination of pressures on revenue and the potential for dramatically reduced costs are features of many technological changes, particularly those involving digital convergence or digitization. Our

findings uncover an important mechanism driving incumbents' responses to new technologies that has not been explored in prior work. Although the technological change appears to be competence-destroying (Tushman and Anderson, 1986), the interrelated set of expensive capabilities that incumbents possess actually retain value, but now for a narrower set of new product releases – those with the broadest market appeal. Thus, incumbents appear to have incentives not to reduce costs, and the continued use of their capabilities and focus on greater selection appear to be complementary. Although prior work has studied how valuable complementary assets might guide incumbents' responses to new technologies (e.g. Tripsas, 1997), such research has not considered how strategic positions evolve as they do so.

Limitations and opportunities for future research

There are data limitations in this study that future studies may be able to overcome. First, we are limited to studying revenue from the traditional sources in the US. Ideally, we would have additional data on revenue for record labels, including international revenue, revenue from streaming, and revenue from other sources such as live concerts. Thus, it is difficult for us to say with certainty what happens to the total revenue of these label organizations following the technological change. It seems likely, given documented trends in the industry, that the majors have also pursued additional sources of revenue, such as live concerts. Such revenue would also likely be greater for artists with wider appeal.

We also lack data on costs. Our findings are highly consistent with the ideas that independent labels adopt lower cost approaches but major labels do not, and the idea that barriers to entry are lowered in the industry, spurring significant new entry. Data on costs in these areas and also the costs of the majors' increased leverage of past success would be helpful for studying performance outcomes more carefully. One aspect of cost that would be useful to study in subsequent work pertains especially to the increase in external selection. While the traditional approaches for internal discovery by the major labels had characteristics of sustainable competitive advantage (discovering talent that others do not yet see, suggesting that organizations might be able to make relatively small investments and benefit from relatively large gains later), acquiring already-successful artists potentially subjects interested major labels to higher prices and bidding wars. Thus, although we can observe higher average revenues for the

major labels, in part due to the dramatic increase in external selection or exploitation, we cannot directly account for the costs or assess the profit associated with these acquisitions.

An additional opportunity for future research is to understand how the behavior of incumbents, particularly the major labels, influences longer term adaptation and success. A well-established idea in strategy research is that at the organization level, although concerted exploitation can lead to better short-term performance, exploration into novel domains is necessary for longer-term success (March 1991, Levinthal and March, 1993). Research in this area has underscored the importance of maintaining a balance between exploration and exploitation (e.g. O'Reilly and Tushman, 2008), corresponding in our case to the idea of 'discovery' versus 'selection.' A question raised by our study is the extent to which the hyper-exploitation we observe in this setting as firms resort to selecting on the most promising talent will enable these organizations to succeed long term. It is important to understand how longer term outcomes compare for firms adopting a more selective strategy and firms continuing to pursue discovery of new-to-the-world artists.

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Figure 1 – Total Value of Sales of Recorded Music in the U.S. (in billions of 2010 $US)

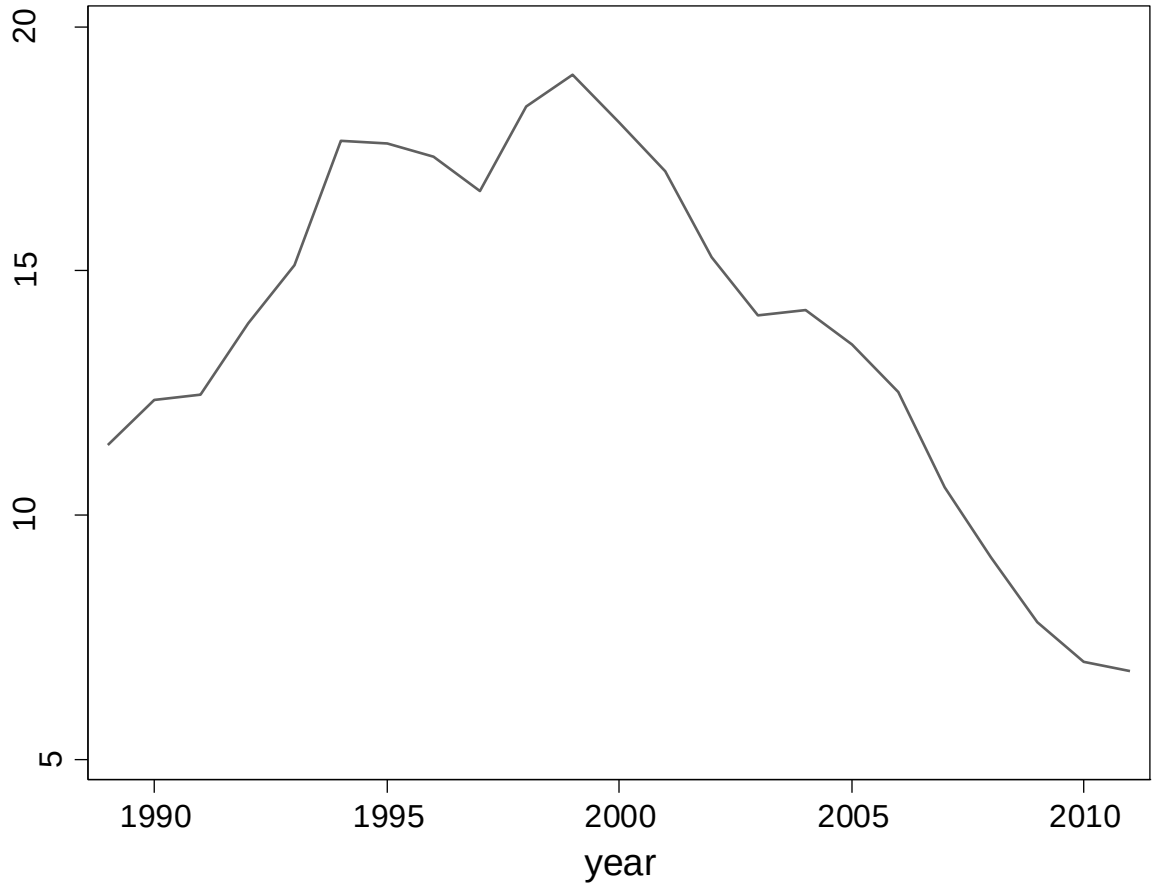


Figure 2 – Selectivity over Time: Share of New Releases from Artists with Past Success on the Billboard Top 50 or Top 200 Chart Listings
Major labels versus non-major labels

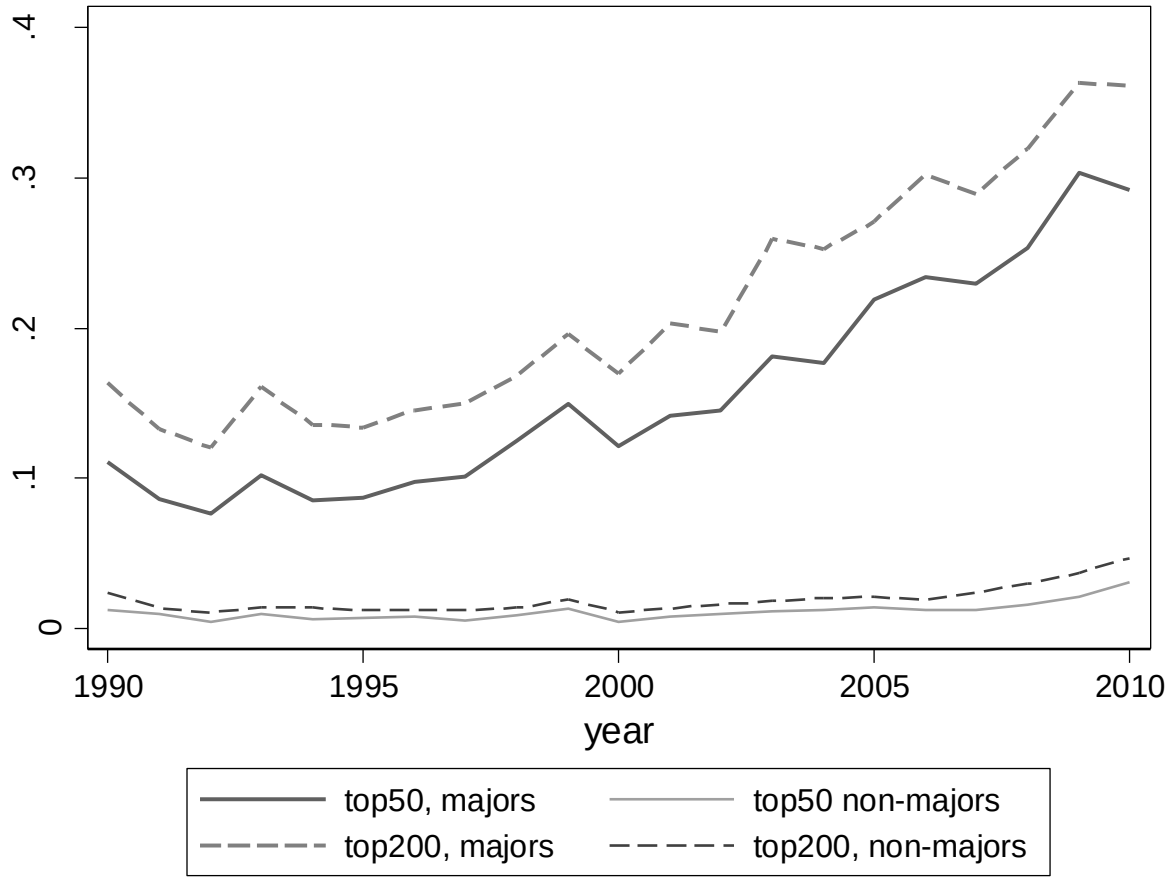


Figure 3 - Number of New Releases by Record Label Type

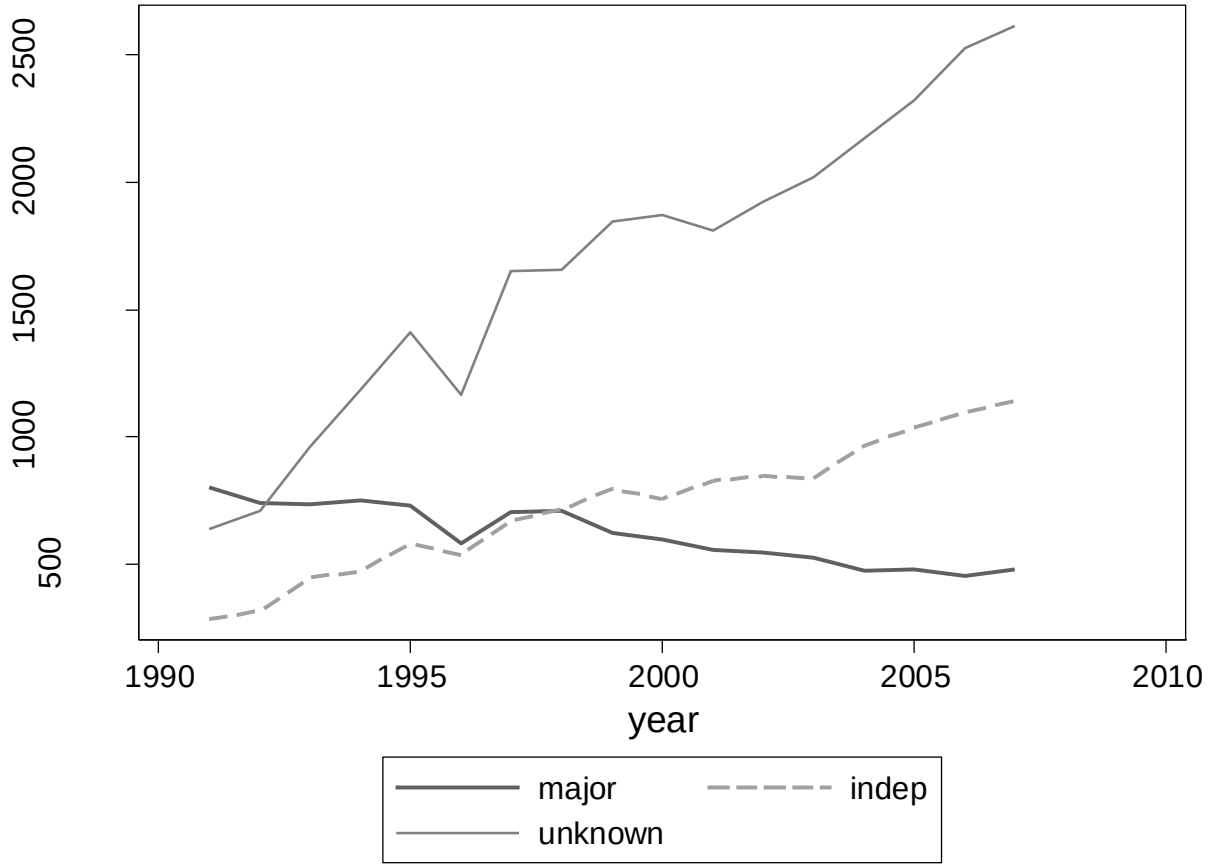


Figure 4 – Label entry – Number of New Record Labels each Year

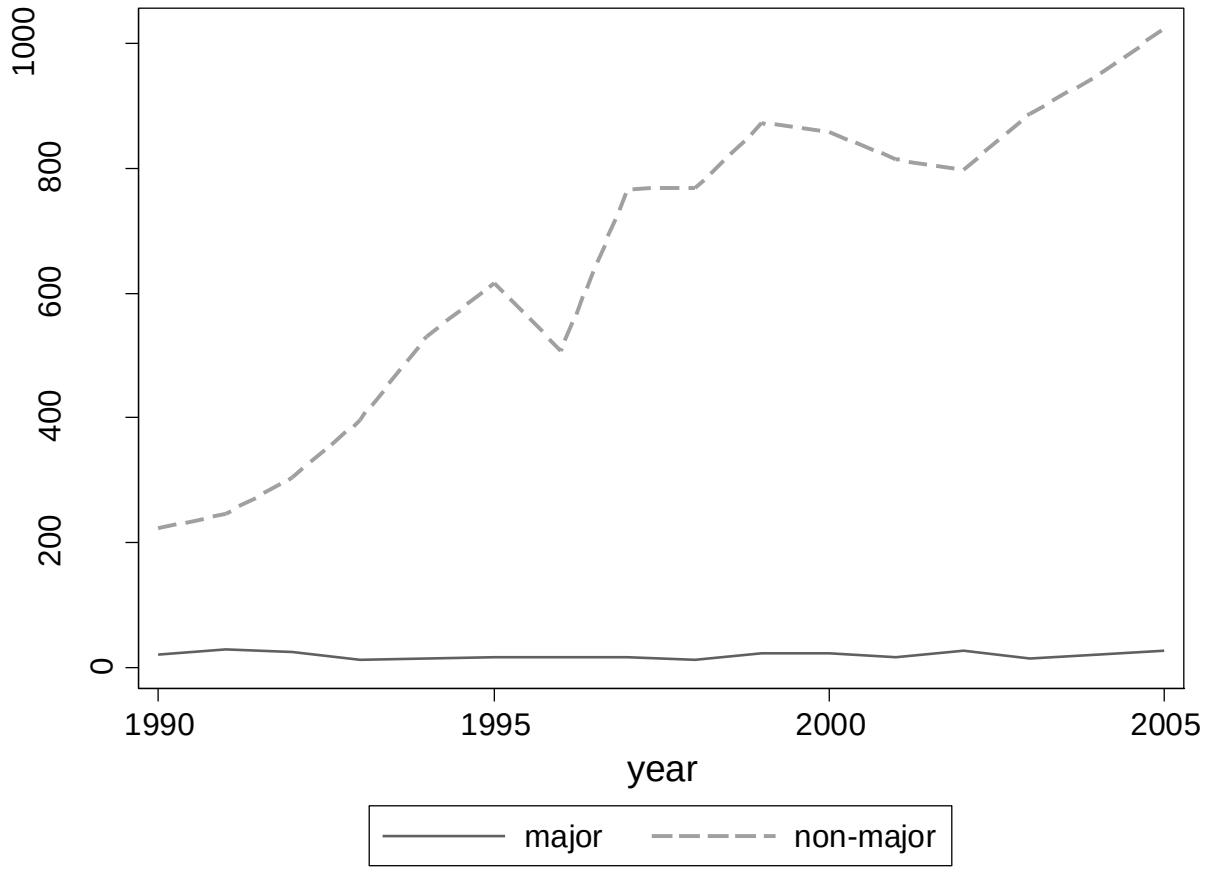
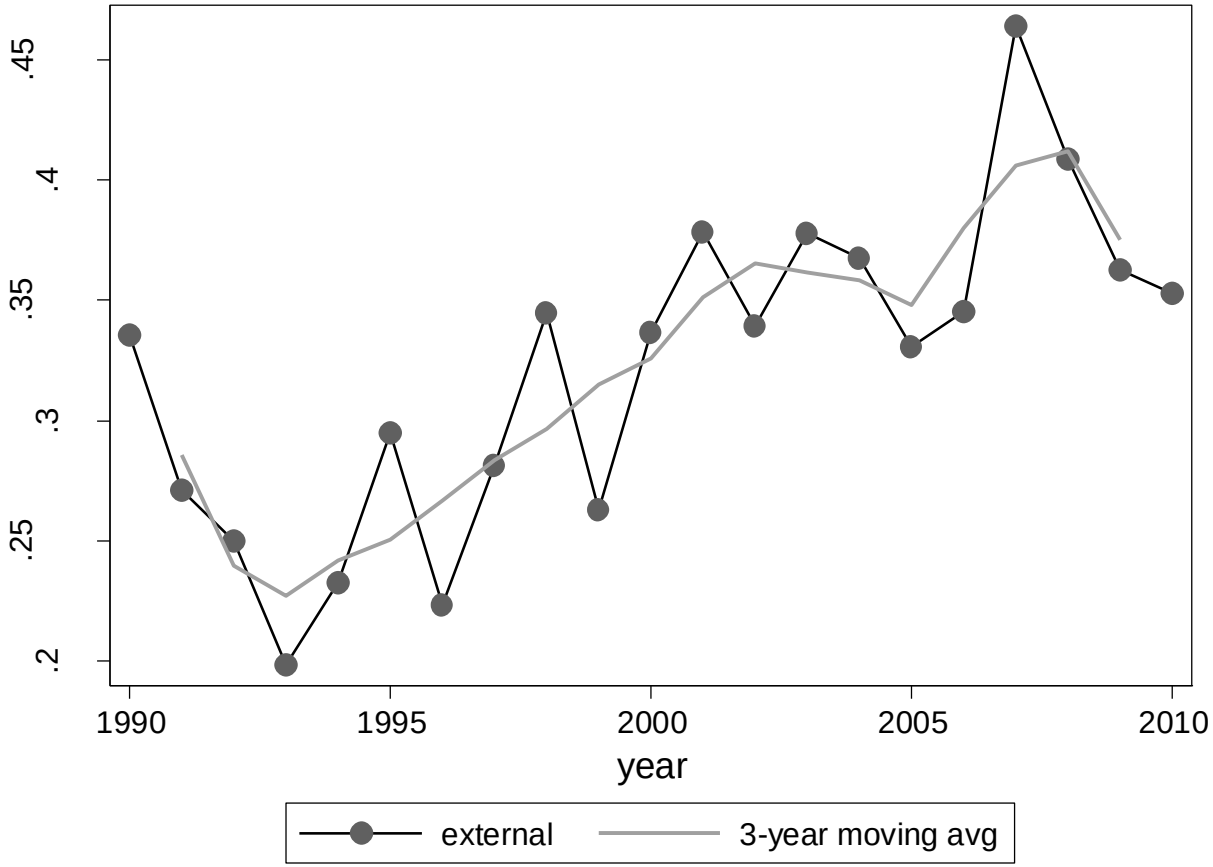


Figure 5 – Share of Majors' New Releases by Previously Successful Artists from "External" Sources



Notes: Of new releases by artists who have had prior success on the Billboard top 200, the figure shows the share that are "external" (i.e. their previous success occurred on a different label than the current release).

Figure 6 - New Releases Achieving Billboard top 200 Success, by Label Type

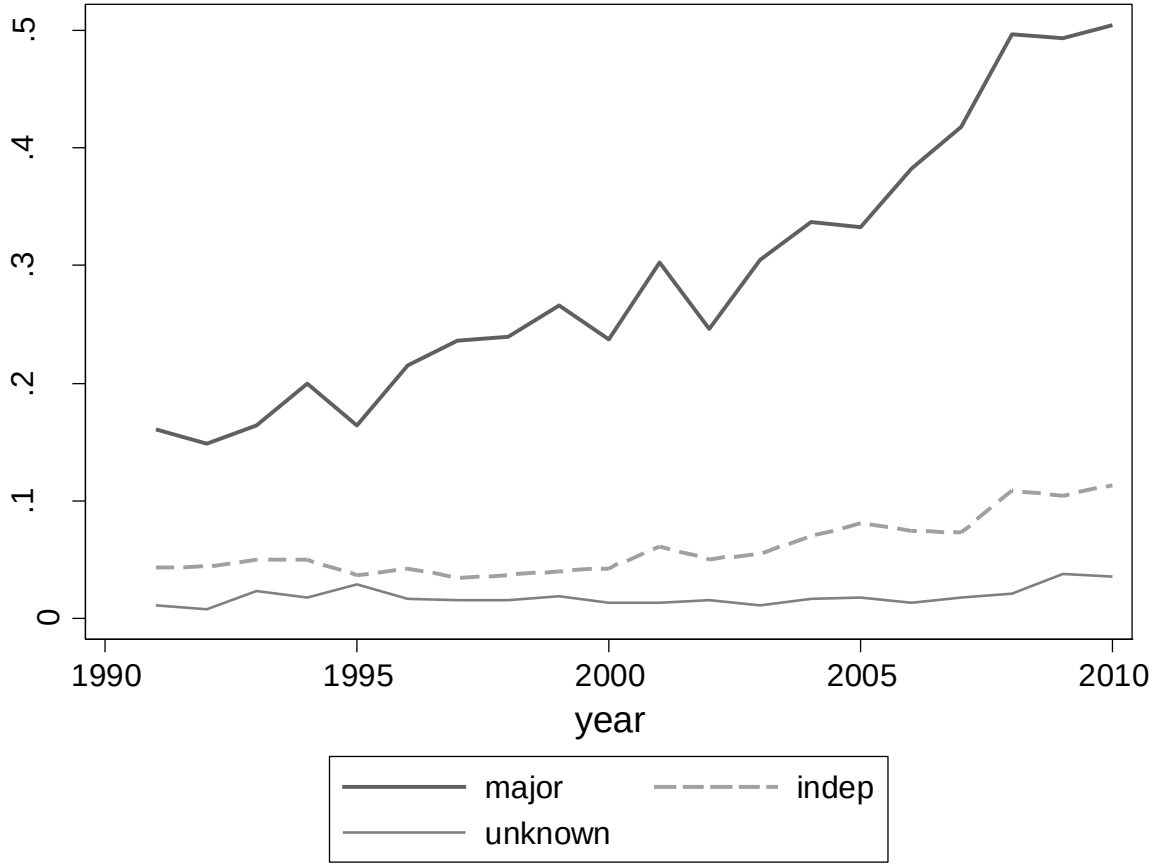
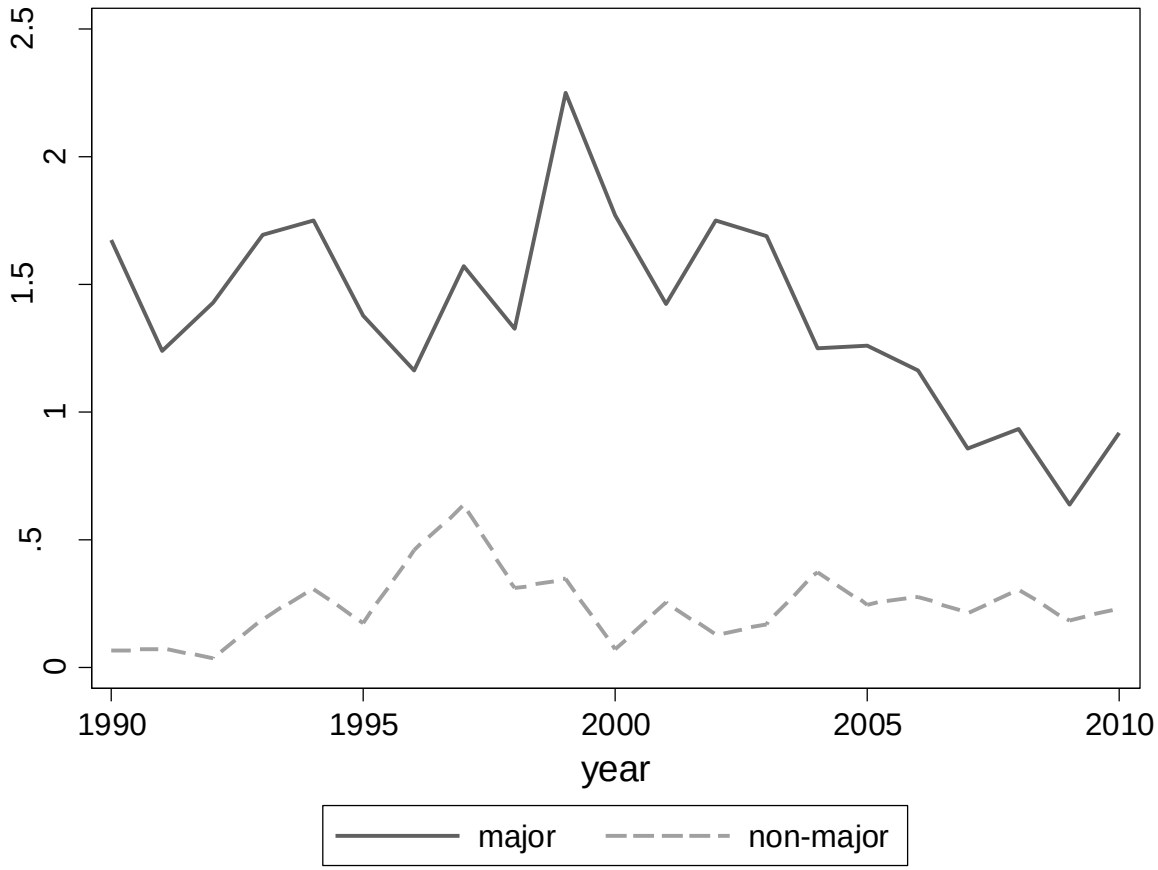


Figure 7: Estimated Revenue for Major and Non-Major Releases



Notes: Estimated sales indices for major-label releases and other (non-major) releases. Estimates based on album sales ranks in conjunction with the aggregate level of recorded music sales by year. Sales are assumed proportional to the reciprocal of rank. See paper text for more detail on how these are calculated.

Table 1: Means and Correlations

	variable	N	mean	1	2	3	4	5	6	7	8	9	10	11
1	log number of releases per label year	32,374	0.353	1.000										
2	this year's release appears in BB200	32,374	0.046	0.137	1.000									
3	this year's release appears in BB50	32,374	0.023	0.104	0.716	1.000								
4	previous release in BB200	32,374	0.031	0.112	0.828	0.657	1.000							
5	previous release in BB50	32,374	0.021	0.087	0.703	0.665	0.847	1.000						
6	Major label x post-1999	32,374	0.041	0.158	0.352	0.347	0.314	0.292	1.000					
7	Augmented major label measure x post -1999	32,374	0.048	0.186	0.320	0.317	0.286	0.266	0.923	1.000				
8	major label x post-1990	32,374	0.075	0.277	0.373	0.342	0.321	0.286	0.725	0.665	1.000			
9	major label x post-1995	32,374	0.057	0.209	0.373	0.351	0.328	0.300	0.840	0.773	0.863	1.000		
10	major label x post-2000	32,374	0.037	0.145	0.348	0.345	0.312	0.292	0.948	0.875	0.687	0.796	1.000	
11	major label x post-2005	32,374	0.017	0.097	0.293	0.306	0.269	0.260	0.639	0.590	0.464	0.537	0.675	1.000

Table 2: Selection by Label Type over Time

	(1)	(2)	(3)	(4)	(5)
	Major vs indep	Major vs non-major	Major vs indep	Major vs non-major	Major° vs non-major
post '99 x major	0.0700	0.0934			
	(0.0106)**	(0.0068)**			
post '90 x major			-0.0027	-0.0145	
			(0.0207)	(0.0117)	
post '95 x major			0.0441	0.0532	
			(0.0120)**	(0.0056)**	
post '00 x major			0.0296	0.0406	
			(0.0089)**	(0.0041)**	
post '05 x major			0.0743	0.0954	
			(0.0124)**	(0.0044)**	
treat N>40 unknowns as major					0.0769
					(0.0161)**
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Label fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.0459	0.0026	0.0518	0.0081	0.0015
	(0.0148)**	(0.0130)	(0.0159)**	(0.0121)	(0.0136)
R^2	0.49	0.60	0.49	0.60	0.60
N	7,161	32,374	7,161	32,374	32,374

Notes: Dependent variable is the share of a label's releases presenting an artist who previously appeared in the Billboard 200. The columns headings "vs indep" and "vs non-major" compare major labels to a) independent labels and b) the combination of independents and labels of unknown type, respectively. All specifications include label fixed effects and year fixed effects. Standard errors (in parentheses) in all columns are clustered on the adjusted label variable that treats all major labels as one. °Modified to include unknown labels with greater than 40 music releases as majors. * $p<0.05$; ** $p<0.01$.

Table 3: Aggregate Releases by Year and Label Type

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Major vs indep	Major vs non-major	Major vs indep	Major vs non-major	Major vs indep	Major vs non-major	°Major vs non-major
post '99 x major	-1.1148	-1.1199	-0.4430	-0.3375			
	(0.1725)**	(0.2601)**	(0.0645)**	(0.0343)**			
Major label	0.4248	0.0075					
	(0.1248)**	(0.1883)					
post '90 x major					-0.2637	-0.2062	
					(0.1090)*	(0.0552)**	
post '95 x major					-0.1856	-0.1789	
					(0.0691)**	(0.0330)**	
post '00 x major					-0.2843	-0.2155	
					(0.0596)**	(0.0260)**	
post '05 x major					-0.2065	-0.1223	
					(0.0453)**	(0.0200)**	
treat N>40 unknowns as major							-0.2838
							(0.0639)**
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Label fixed effects			Yes	Yes	Yes	Yes	Yes
Constant	5.9237	6.1921	0.9230	0.3796	0.8530	0.3223	0.3825
	(0.2070)**	(0.2876)**	(0.1228)**	(0.1007)**	(0.0754)**	(0.0568)**	(0.1032)**
R^2	0.75	0.57	0.69	0.69	0.70	0.69	0.69
N	42	63	7,161	32,374	7,161	32,374	7,161

Notes: In columns (1) and (2) the unit of observation is the label type (major, etc.) year, and the dependent variable is the log of the total number of releases. In subsequent columns the unit of observation is a label year, and the dependent variable is the log of the number of releases at the label. The columns headings "vs indep" and "vs non-major" compare major labels to a) independent labels and b) the combination of independents and labels of unknown type, respectively. All regressions include year effects. Columns (3)-(7) include label fixed effects. °Modified to include unknown labels with greater than 40 music releases as majors.

* $p<0.05$; ** $p<0.01$.

Table 4: Success by Label Type over Time

	(1)	(2)	(3)	(4)	(5)
	Major vs indep	Major vs non-major	Major vs non-major	Major vs non-major	°Major vs non-major
post '99 x major	0.0785	0.1103			
	(0.0132)**	(0.0082)**			
post '90 x major			-0.0040	-0.0114	
			(0.0220)	(0.0141)	
post '95 x major			0.0520	0.0662	
			(0.0152)**	(0.0070)**	
post '00 x major			0.0291	0.0486	
			(0.0116)*	(0.0052)**	
post '05 x major			0.0877	0.1108	
			(0.0147)**	(0.0052)**	
treat N>40 unknowns as major					0.0910
					(0.0194)**
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Label fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	0.0710	0.0105	0.0775	0.0187	0.0093
	(0.0161)**	(0.0164)	(0.0172)**	(0.0147)	(0.0171)
R^2	0.56	0.65	0.57	0.65	0.65
N	7,161	32,374	7,161	32,374	32,374

Notes: Dependent variable is share of a label's current releases that appear in the Billboard 200. The columns headings "vs indep" and "vs non-major" compare major labels to a) independent labels and b) the combination of independents and labels of unknown type, respectively. All specifications include label fixed effects and year fixed effects. Standard errors (in parentheses) are also clustered on the adjusted label variable that treats all major labels as one. °Modified to include unknown labels with greater than 40 music releases as majors. * $p<0.05$; ** $p<0.01$.