

How Digitization Has Created a Golden Age of Music, Movies, Books, and Television

Joel Waldfogel

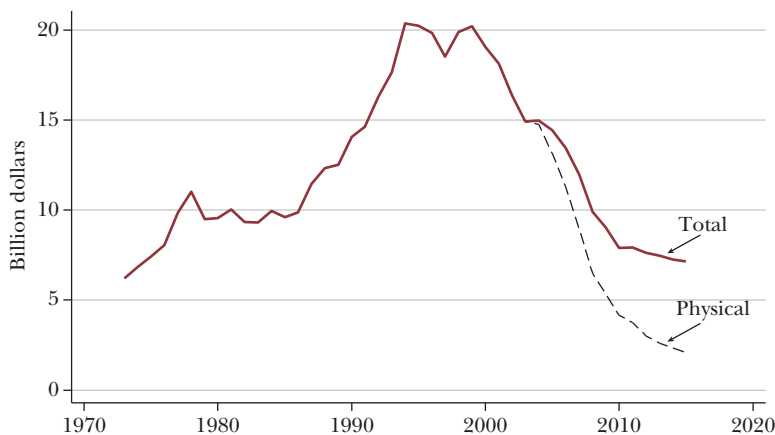
Digitization is disrupting a number of copyright-protected media industries, including books, music, radio, television, and movies. Once information is transformed into digital form, it can be copied and distributed at near-zero marginal costs. This change has facilitated piracy in some industries, which in turn has made it difficult for commercial sellers to continue generating the same levels of revenue for bringing products to market in the traditional ways. The recorded music industry offers a vivid example. Revenue in the recorded music industry had grown steadily throughout the twentieth century but began a precipitous slide in 1999 and has now fallen by more than half (see Figure 1). Yet despite the sharp revenue reductions for recorded music, as well as threats to revenue in some other traditional media industries, other aspects of digitization have had the offsetting effects of reducing the costs of bringing new products to market in music, movies, books, and television. On balance, digitization has increased the number of new products that are created and made available to consumers. Moreover, given the unpredictable nature of product quality, growth in new products has given rise to substantial increases in the quality of the best products and therefore the benefit of these new products to consumers.

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Figure 1
Total Value of Annual US Music Shipments



Source: Author's calculations from Recording Industry Association of America's reported annual value of music shipments, along with inflation adjustment using the Consumer Price Index.

Note: The figure shows the annual retail value of recorded music sold in the United States, according to the Recording Industry Association of America, in constant 2016 dollars inflated using the Consumer Price Index.

We begin with a discussion of how digitization has threatened the traditional revenue sources for some of these media industries, notably recorded music. We then turn to how digitization has greatly reduced the cost of bringing new products to market in music, books, movies, and television. The reduction in production costs has made the launch of new products in these markets much easier. However, the disruptions and reductions of revenue streams have challenged the roles of the traditional gatekeepers of quality in these industries, including book publishers, recording labels, movie studios, and television networks. These developments have raised concerns that consumer welfare from these media products would fall, on the grounds that high-quality products could not be produced profitably and consumers would be flooded with low-cost and lower-quality products. However, the opposite scenario has emerged—a golden age for consumers who wish to consume media products. For example, consumers have benefited from a wider range of media products available. Moreover, because traditional gatekeepers were imperfect judges of quality, the growth in new products that turn out to be of high quality has presented consumers with many products that would not have met the approval of traditional, pre-digital gatekeepers. Of course, measuring quality in these industries in a direct way is impossible, but a variety of ratings by experts and the public, as well as direct evidence from consumption patterns, suggest that product quality has risen in these media industries. We take up the question of how revenue streams for these industries may be rebuilt in the future, with a focus on the potential of bundled sales strategies and live performance. I conclude with some implications for public policy and future research.

Digitization, Round 1: Piracy and Revenue Reduction in Music

Media industries have several main sources of revenue, including advertising as well as direct and indirect payments from users. Digitization has disrupted many of these streams.

In the recorded music industry, the first manifestations of digitization were sharp and sustained reductions in revenue, and the proximate cause was almost surely piracy. With the appearance of the Napster peer-to-peer file sharing service in 1999, consumers could access almost any piece of recorded music without making a payment to a rights-holder. Recorded music revenue began a sharp and sustained slide, both in the United States and around the world, in 1999. As Figure 1 shows, the rise in digital music sales after 1999 did not nearly offset the decline in physical sales. In the early 2000s, scholars debated whether unpaid access to recorded music would stimulate or depress demand for paid access over time. Perhaps taste-setting consumers involved in music file-sharing would sift through new music, making suggestions to follow-on consumers, and thus stimulate demand for purchasing additional music? After all, when radio broadcasting arrived in 1920s, sales of recorded music fell for a time, but then recorded music revenue rose fairly steadily after the 1920s (Liebowitz 2004).

The task of estimating how the growth in web-based music file-sharing depressed revenue turned out to be difficult to address, for a variety of reasons. While data on legal sales are available, data on consumption of unpaid music are hard to obtain. Moreover, even with data on volumes of paid and unpaid music consumption at the product level, it's difficult to identify the causal impact of stealing on buying. Works that are popular to buy are also popular to steal (Oberholzer-Gee and Strumpf 2007; Blackburn 2004), but the positive correlation between how much any work is stolen and how much it is purchased clearly does not prove that stealing music causes additional buying of that music.

These difficulties led a number of researchers to survey-based individual data, which seeks to elicit individuals' responses on their volumes of purchases and unpaid consumption of musical works. Studies of this nature, some of which examine within-individual variation across vintages, tend to find that stealing does depress buying (Zentner 2006; Rob and Waldfogel 2006; Waldfogel 2010). As the evidence has developed, most scholars in this area now agree that the unpaid consumption made possible by digitization is responsible for the lion's share of the revenue reduction in the music industry (for example, Liebowitz 2016).

The recorded music industry, which faced the toughest test because it was the first of the media industries to face digitization, did not develop an attractive legal method of digital distribution until Apple created the iTunes Music Store, four years after Napster (Knopper 2009). While this response may have been reasonably prompt by the standards of some industries, the four years between Napster and iTunes allowed consumers to grow accustomed to obtaining music without payment.

While the threat to revenue arising from the prospect of digital piracy exists for audio, video, and text—and hence for music, movies, television, and books—neither

movies, books, nor television have experienced a revenue decline resembling the collapse of recorded music revenue. The motion picture industry may have been protected from an explosion of piracy by the fact that video files are larger and more cumbersome to download than audio files. But in addition, adjacent media industries may have learned from this earlier experience that adapting to the new digital formats and searching for alternative revenue sources was more effective than trying to block them. YouTube appeared in February 2005, and people began uploading copyright-protected *Daily Show* clips without permission. While Viacom, the parent of Comedy Central, sued YouTube's parent Google for \$1 billion, most television broadcasters embraced digital technology. By fall 2005, less than a year after YouTube's appearance, a few networks were posting episodes online at their own websites. By fall 2006, virtually all shows were posted online, free to consumers, for a few weeks after airing (Waldfoegel 2009). Consumption of digital books requires complementary hardware, and the development of Amazon's Kindle reader was accompanied by the widespread availability of reasonably priced books at Amazon. Similarly, the growth in streaming video platforms such as Netflix and Amazon Instant has been accompanied by complementary technology for delivering video content to large television screens opposite couches, and not simply computers and phones. We will return later to the question of how digitization may offer additional revenue flows for media industries.

Digitization, Round 2: Falling Costs and Growth in the Number of New Products

While only some media industries—recorded music as well as newspapers—have faced the bad news of reduced revenue, all media industries experienced good technological news in the form of cost reduction. That is, digitization has brought substantial reductions in the costs of production, distribution, and promotion of new products in music, books, movies, and television. As a result, the gatekeeping role of media companies has been democratized.

The traditional model for bringing recorded music products to market involved several steps. First, a record label needed to identify a promising artist and sign the artist to the label. Second, the label spent substantial sums of money producing a recording, using expensive recording equipment and skilled workers. Next, the label produced a music video for television and secured the airplay of songs on the radio. Finally, the label had the album physically produced and shipped to stores. Because demand for popular music is often ephemeral, it was important for the product to be readily available during the few weeks it might be in high demand. The International Federation of the Phonographic Industries (2010) estimates that this mode of bringing music to market costs \$1 million for an album from a new artist. And most releases were commercially unsuccessful (Vogel 2007; Caves 2000).

Digitization has offered low-cost alternatives to many of the steps in bringing products to market. Production is now far less expensive. An artist can create a

passable recording with an inexpensive microphone and the software on a computer or even a smart-phone. Distribution can be entirely digital. For about \$10, an artist can make a song available on iTunes (Waldfoegel 2015). Promotion remains a challenge, but many outlets review new music, including old-economy magazines such as *Rolling Stone* as well as born-online outlets such as Pitchfork. These reviews are available online, free of charge, and collected at sites such as Metacritic. Metacritic contains reviews of about 1,000 albums a year, whereas traditional terrestrial radio gives broad exposure to about 300 artists per year (Waldfoegel 2015). Moreover, artists have opportunities to promote their work outside terrestrial radio, using YouTube, or online radio services such as Spotify and Pandora. There is some question about whether these outlets serve as demand-stimulating advertising or demand-depressing alternatives to the purchase of permanent download (as I discuss below in the context of revenue opportunities from bundling). However, rights-holders do get some payment for the use of their music via these outlets (for a sampling of the arguments on these issues, see David Lowery's blog at <https://thetrichordist.com>).

Gatekeeping roles have been transformed in other media industries as well. In the book publishing industry before digitization, and even as late as 2006, an author hoping for commercial success needed an agent who could help convince an editor at a major publishing house to publish the book (the discussion here draws on Waldfoegel and Reimers 2015). Most manuscripts were rejected by agents. Publishers also screened the works, did some editing, and then had books printed and shipped to stores. Some books produced in this manner achieved sales success, although most did not. Publishers also provided information to taste-making critics, who might then provide reviews. With the development and widespread adoption of the e-book in 2007, these arrangements shifted. Since 2007, it has been possible for authors to create manuscripts, upload them to Amazon's Kindle Direct Publishing platform (or one of a number of others, such as Lulu) and then achieve multinational distribution without gatekeeping agents, editors, or publishers. Authors have availed themselves of these opportunities for self-publishing in substantial numbers.

As with other media industries, book promotion by individual or small-scale producers remains challenging. But digitization has sharply enriched the information environment in books. While traditional publications (newspapers and magazines) collectively provided roughly 50,000 reviews per year—with many books reviewed by multiple outlets and with the largest outlets reviewing about 8,000 titles—the number of books reviewed and rated on digital platforms is far larger. The two largest repositories of customer rating information about books are the user-generated review site Goodreads (with 10 million user reviews of 700,000 titles as of 2014) and Amazon's site. In fact, Amazon purchased Goodreads in 2014, making Amazon the owner of an enormous and difficult-to-imitate trove of review information.

Digitization has had similarly disruptive effects on the movie industry (the discussion here draws on Waldfoegel 2016). The vast majority of the revenue for the movie industry has traditionally come from the major Hollywood studios, which

make up the membership of the Motion Picture Association of America (MPAA). The MPAA members have released between 150 and 250 movies per year into theaters over the past quarter-century. These movies have been quite expensive to make, averaging \$106 million per film in 2007, the last year the MPAA released statistics.

The traditional model for movie distribution was to invest a large amount in a film thought to have promise, using well-known actors paid as much as \$20 million or more for a single film as well as expensive cameras and equipment, and then to distribute the product in physical form to movie theaters around the world. But digitization has dramatically altered the parameters of both cost and distribution. Since about 2005, the cost of making a distribution-quality movie has fallen drastically. Digital SLR (single-lens reflex) cameras, using interchangeable lenses and capable of shooting high-definition video, have become available for a few thousand dollars, which is roughly 1 percent of the price of pre-existing distribution-quality film cameras. The reduction in the cost of this input is not material to a \$100 million production budget, but it does enable filmmakers who lack MPAA-level financing to create professional-looking movies. On the distribution side, the number of physical theaters put a sharp constraint on the number of films that could effectively be distributed to consumers in the past. However, digitization has brought many new distribution channels, including video-on-demand through cable television operators, as well as pure online distribution through subscription platforms such as Netflix, Hulu, or Amazon Prime or a la carte platforms such as Amazon Instant.

In 2012, 550 films were distributed through US theaters: about 200 of these were MPAA major-studio movies, while the other 350 were small-scale releases of mostly independent movies. In many cases, these films were released briefly in just a few theaters to get some reviews, then, later, distributed through other channels. As of 2013, the number of 2010 releases available streaming on Netflix was 1,058, and the number on the Amazon Instant service was 1,230, or roughly twice the number of 2010 movies that had been available in theaters. The bottom line is that the barriers to entry into creation have fallen and the distribution bottleneck has been relaxed, making it possible for a large number of new movies to make their way to consumers.

Conditions for television programming are similar (the discussion here draws on Waldfogel 2017). As in the movie context, the physical costs of production (like cameras and recording media) have fallen substantially while channel capacity has grown enormously. Between the dawn of television and about 1990, the three national networks could accommodate about 25 new television series per year. With the growth of basic cable channels in the 1990s, the distribution capacity for new shows expanded. With the diffusion of digital cable systems, channel capacity grew to roughly 150 channels (Waldfogel 2017). Finally, the growth of the high-speed Internet has enabled asynchronous online distribution of new and old programs online via platforms such as Netflix, Hulu, and Amazon. Channel capacity is now effectively unlimited.

Even the Losers Get Lucky Sometimes: “Nobody Knows Anything” and the Welfare Benefit of New Products

Reductions in the cost of bringing products to market or making them available to consumers will increase the number of options facing consumers. One common metaphor used to describe the increased choices that consumers face since digitization is “the long tail” (for an academic treatment, see Brynjolffson, Hu, and Smith 2003; for a popular account, see Anderson 2006). The idea is well-illustrated by a comparison between the welfare consumers derived from, say, the 50,000 titles available in their local book stores compared with the 1,000,000 titles available to them from a retailer like Amazon that effectively has infinite shelf space. While each of the additional 950,000 titles has low demand, the sum of the incremental welfare delivered by many small things may be large. Brynjolffson, Hu, and Smith (2003) estimate that US consumers derived \$1 billion in annual consumer surplus from the wide online selection. They derive this conclusion from the substantial share of book sales accruing to “long tail” books available at Amazon but presumed to be unavailable at a typical local store.

While the “infinite shelf space” perspective on the effect of digitization on consumer welfare is instructive, I wish to emphasize a separate effect of digitization on consumer welfare, drawing on Aguiar and Waldfogel (forthcoming). The reduction in the cost of bringing new products to market outlined above not only makes it possible for retailers to *carry* additional products; it also allows creators to *make* more products. It turns out that the unpredictability of appeal of new products has a large impact on the welfare benefit of new products.

To understand this point, first consider a world in which the quality of new products is entirely predictable at the time of initial investment. Suppose that gatekeepers (like record labels, movie executives, and book publishers) hear pitches and form estimates of expected revenue y' from prospective projects. If the estimate of expected revenue exceeds the cost threshold T , then the project goes forward. Otherwise the project does not. Initially, suppose that gatekeepers can forecast revenue without error. Then all projects with expected revenue $y' > T$ are released. When digitization reduces the cost of launching products from T to T' , then more products get produced and released. Consumers get access to new products, but all of these new products have lower expected *and* realized appeal than the least marketable product previously made available. In this circumstance, with perfectly predictable product quality, the additional product releases made possible by cost-reducing digitization increase consumer welfare in the same way that adding shelf space raises consumer well-being.

However, the unpredictability of outcomes raises the possibility that a cost reduction that stimulates new products will deliver a much bigger welfare benefit. To see this, suppose that gatekeepers are unable to forecast market appeal with complete accuracy. Then their guess is the true value plus an error term, or $y' = y + \varepsilon$. Because of unpredictability, some projects have realized marketability above the initial cost threshold T ; others below. When digitization reduces the

entry threshold from T to T' , additional projects with modest expected revenues—expected marketability between T and T' —are brought to market. But because of unpredictability, high realized quality appears throughout the distribution of projects, many of which would previously have been rejected by gatekeepers. Some of the products that had been expected to “lose” instead turn out to be winners, in the form of best-selling products.

Unpredictability is a generic feature of creative products, as Caves (2000) and Vogel (2007) emphasize, with evidence that roughly 5–10 percent of new creative products achieve success in the sense of generating revenue in excess of their costs. As screenwriter William Goldman (1984) said in his *Adventures in the Screen Trade*: “NOBODY KNOWS ANYTHING.” Hence, we should expect digitization to have a big effect on the welfare benefit that consumers derive from growth in the number of new products.

In short, cost reduction allows creators to take more draws from a lottery of possible winners. Given unpredictability, some proportion of the additional draws will deliver some additional high-quality products, which, in turn, could raise the quality of the choice set facing consumers. If correct, this characterization has three empirical implications: 1) the number of new products will rise; 2) the service flow that consumers derive from the new vintages will rise; and 3) many new products expected to have been losers, in the sense that they would not have made it past the traditional gatekeepers, will make up a growing share of the actual winners in these markets. The next sections explore these three implications.

Evidence of a Digital Renaissance

The Number of New Products

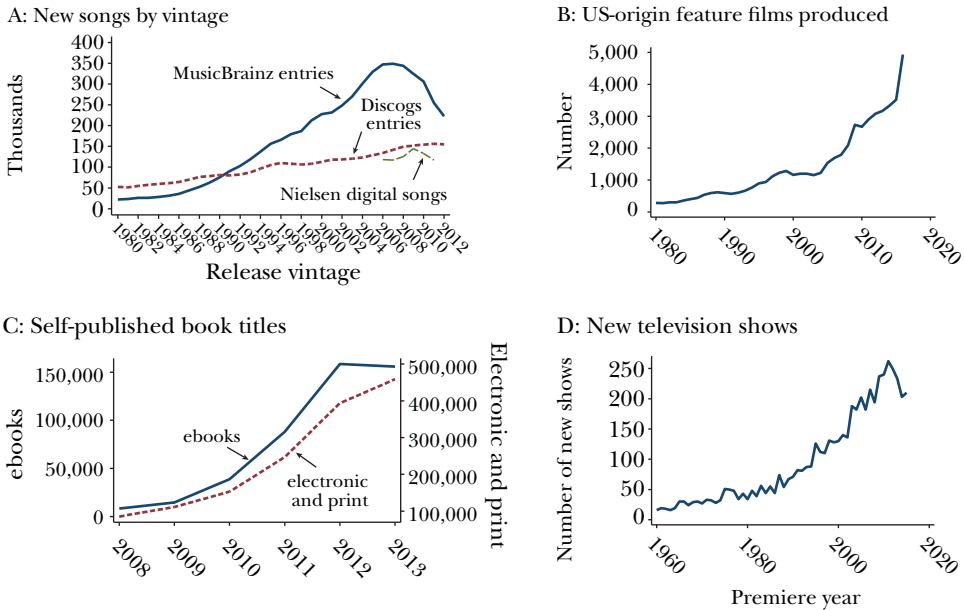
While obtaining data on the number of new products can be challenging, it is clear that the number of products brought to market has grown sharply in each of the media product contexts. Figure 2 presents some measures of the numbers of new products brought to market in the US in each of four industries.

Figure 2A shows that the estimate of the number of new recorded music works released differ across sources, but all agree that the number has risen since about 2000. According to entries in the Musicbrainz database, the number of new songs added annually rose steadily from about 50,000 in 1988 to almost 350,000 in 2007. Other reports put the growth in the number of new recorded musical works at a tripling between 2000 and 2010 (for details, see Aguiar and Waldfogel 2016, forthcoming).

The growth in motion picture production is similarly large (Figure 2B). Based on production data in the Internet Movie Database (IMDb), the number of new motion pictures produced in the United States rose from about 500 features in 1990 to 1,200 in 2000, and by 2010 had risen to nearly 3,000. Growth in US-origin documentaries is even larger, and the patterns for other countries are similar (Waldfogel

Figure 2

Number of Products Brought to Market in Four Media Industries



Source: The data on new songs comes from MusicBrainz, Discogs, and Neilson; on self-published books, from Bowker; on feature films, from IMDb; and on television shows, from epguides.com.

2016). Not all of the new movies are marketed to consumers, but even the number distributed to consumers through some familiar distribution channel—theaters, Amazon, Netflix, iTunes—has at least doubled between 2000 and 2010.

The growth in new books has been even larger (see Figure 2C). Much of the growth in new books has come from self-published works, and their growth has been substantial, from about 85,000 new titles in 2008 to almost 400,000 new titles in 2012 (reading off the right axis) (Waldfoegel and Reimers 2015).

Finally, Figure 2D shows the number of new US television series grew from about 25 to 50 over 1960–1980, rose to 100 by 2000, and has since topped 250 (according to epguides.com). Production-based estimates derived from IMDb show the same time pattern, but roughly ten times the level (Waldfoegel 2017).

It is clear that the numbers of new musical works, movies, books, and television shows created and made available to consumers have risen sharply since digitization.

The Service Flow Delivered by New Products

Of course, the large number of new products does not guarantee or even imply any substantial growth in the service flow delivered by the new vintages. Some cultural critics have decried an onslaught of amateurish cultural products (Lemann 2006). For example, one of the fruits of digitization is the growth in the number of YouTube videos depicting cats on Roombas—a brand of robot vacuum cleaner that

navigates autonomously around a room.¹ Still, it is possible that the large recent crops of cultural products include valuable entries.

Determining the welfare benefit that consumers derive from the new works requires some assessment of the quality of the new works. “Quality” is a loaded word for creative products, so it is helpful to be more specific. I have measured the service flow of new cultural products based on consumers’ buying decisions, and where that is not possible, I measure quality based on the judgment of critics. I am particularly interested in trends in quality since the introduction of Napster in 1999 as indicated by a vertical line in the panels of Figure 3.

A first critic-based approach employs intertemporally comparable assessments. One form of this approach is multiyear “best of” lists, such as the *Rolling Stone* list of the best 500 albums of all time. In Waldfoegel (2012), I create indices from a few dozen underlying music best-of lists, which I combine via a regression to create an index of the number of high-quality releases from each vintage, 1960–2008. I report the resulting index of critically acclaimed music in Figure 3A. The index rises from 1960 to 1970, and then falls. The index also declines from a local peak in the mid-1990s toward 1999. In stark contrast with the time pattern of revenue, which collapsed after Napster, the index of acclaimed music is flat. At least by this measure, the decline in revenue has not undermined the creation of new music that critics find appealing. We return to the evolution of music quality shortly, with usage-based evidence.

A related type of critic-based information comes from information intermediaries that translate movie or music reviews into scores on a 0–100 scale, such as Rotten Tomatoes or Metacritic. In some recent research (Waldfoegel 2016, 2017), I create indices showing the number of movies and television shows, respectively, with ratings above some fixed threshold of critical acclaim. For example, 1993 saw the release of fewer than 40 films receiving scores of 87 or higher on Rotten Tomatoes. Since about 2000, the number has grown substantially, averaging about 80 and reaching 100 in 2012. Hence, the quality of movies produced has been rising in the eyes of critics.

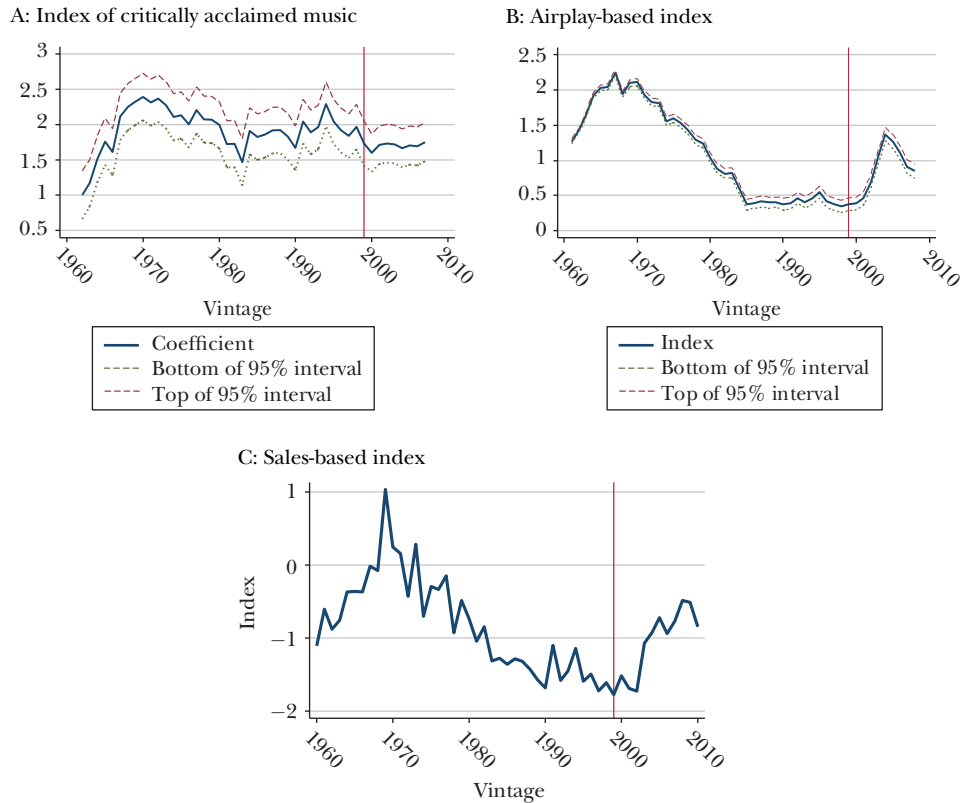
For the evolution of viewers’ assessments of television shows released over the years, I employ user ratings of shows. IMDb users can rate television shows on a 10-point scale, and the IMDb database includes a comprehensive listing of the series premiering each year. An analysis of 13,439 US series premiering between 1970 and 2015 shows rising variance in user-assessed series quality over time, which is highly consistent with the unpredictability hypothesis entertained above. The quality of the shows that turn out (after being produced) to be most appealing to viewers rises. That is, the ratings of the top 25 premiering shows of each year, according to the ratings left by IMDb users, rise sharply over time. One sees a similar time pattern in professional critics’ Metacritic ratings of the top 25 shows of the seasons from 2000 to 2015 (Waldfoegel 2017). Indeed, the observation that we are currently living

¹The “Roomba Cats: Compilation” at YouTube (<https://www.youtube.com/watch?v=mk4XB2wZqF4>) has nearly 500,000 views. I am grateful to Brett Danaher for this colorful reference.

Figure 3

Indices of the Quality of New Music

(the vertical line indicates the creation of Napster)



Source: Figure 3A above corresponds to Waldfogel (2012, figure 3); Figure 3B corresponds to Waldfogel (2012, figure 8); Figure 3C corresponds to Waldfogel (2012, figure 10).

through a television Golden Age is not novel; many observers speak of “peak TV” (for example, Poniewozik 2015).

The second broad approach to assessing the evolution of quality relies on consumers’ choices. At any point in time, consumers can choose either new or old products. Because consumers are generally less enthusiastic about older products than new ones—a phenomenon akin to depreciation—new products tend to be used more at any point in time. This observation gives rise to a way of assessing quality: after accounting for age, are some vintages of, say, music, used more intensively than others? Implementing this approach requires data on consumption of products by calendar time and vintage for multiple calendar years. That is, one needs data on the share of music consumption in 2010 that was music originally released in 2010, 2009, and so on. If one can observe the same thing for calendar 2009 as well as earlier years, then it’s possible to measure directly

whether some vintages are used more or less than others, after accounting for depreciation.

I have implemented this approach using several different datasets, including one based on airplay of US music, 2004–2008, and another one using Gold and Platinum record certifications certifying 0.5 million or sales multiplies of one million between 1970 and the early 2000s (Waldfoegel 2012). Figure 3B and C report the resulting indices. First, as with the independently derived index based on critical acclaim, both of the usage-based indices rise from about 1960 to 1970, then decline. Both have minor fluctuations during the 1990s. However, both rise rather sharply after 1999. These indices indicate that the vintages of music released since Napster are more used, conditional on their age, than the previous vintages. To say this another way, the service flow of the new vintages has risen relative to the vintages of the 1990s.

Some of the methods for measuring the evolution of quality of content are subject to a potential bias toward particular vintages. For example, the views of critical judgments from a particular year might over-value recent work. But some of the methods and data I employ to assess the evolution of quality are immune to this concern: for example, an approach that infers the evolution of music quality from the sales certifications—for albums selling over half a million, and multiples of one million copies—occurring over four decades. While the sales data from, say, a particular decade would reflect the tastes of that decade’s buyers, potentially over-weighting whatever music was popular in that decade, having four decades of sales-based certifications means that the inferences about vintage quality are based on buying behavior over a long period.

The Growing Role of Those Who Expected to Lose, But Ended up Winning

Growth in the experienced quality of new products does not by itself demonstrate that digitization delivered these benefits. After all, quality improvements might have occurred even without the new products. We can explore whether digitization is responsible for the quality of new products by documenting the role of new products among the products that consumers find most appealing. The test for whether digitization is responsible is whether the products with modest expected appeal—or those that would have been expected to be “losers” and thus unlikely to be produced at all at an earlier time—account for substantial and growing shares of the actual winners.

The first task is to identify the output that would have been an expected loser. In the terminology introduced earlier, expected losers are products with expected revenue below the old green-lighting threshold and above the new, lower one (in the terms used earlier, between T and T'), which would not have come to market but for digitization. They are the rejected manuscripts, demo tapes, and story pitches, the would-be products that gatekeepers would have scotched if costs had remained high. A short digression into the markets for music, books, movies, and television provides reasonable guidance on how to identify these expected losers.

The entities traditionally bringing new music to market are divided into two main groups: “major” record labels and “independents.” The majors are owned by major media conglomerates, firms like Warner, Sony, and Universal. While major labels have always issued only a small fraction of the total releases, major label products have accounted for the vast majority of sales—roughly 90 percent as late as 2000. Artists who could obtain major label deals—with their substantial advances, access to radio airplay, and broad distribution—would generally jump at these opportunities. Some artists unable to obtain major label deals could nevertheless obtain independent label deals. In the past 16 years, as Handke (2012) and Oberholzer-Gee and Strumpf (2010) document, there has been substantial growth in independent labels and, more importantly, in releases by independent labels. Empirically, we can treat the releases on independent record labels as the products that would have been expected to be commercial losers by the major labels. In Waldfogel (2012, 2015) and Aguiar and Waldfogel (2016, forthcoming), I ask whether these releases account for a growing share of bestselling works.

We can make a similar distinction in the market for books. Traditionally, the books rejected by mainstream publishers either remained in desk drawers, or perhaps sometimes were self-published by “vanity presses.” Today, as detailed above, many books whose authors cannot secure deals with publishers self-publish their books through Amazon and other platforms. The question, then, is whether such self-published works account for a growing share of best-selling works. I undertake this calculation in Waldfogel and Reimers (2015).

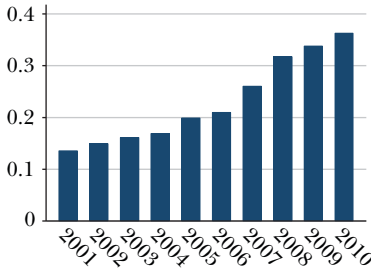
The movie industry, like the recording industry, is divided into major and independent studios. With movies, we can ask what share of box office revenue, or share of works distributed, hail from independent as opposed to major studio sources (as in Waldfogel 2016).

In television, the question is whether shows not originating with the traditionally powerful gatekeepers—the legacy broadcast networks and HBO—account for a growing share of the most popular shows. Thus, I treat shows that premiered outside these traditional channels as expected losers, a theme I explore in Waldfogel (2017).

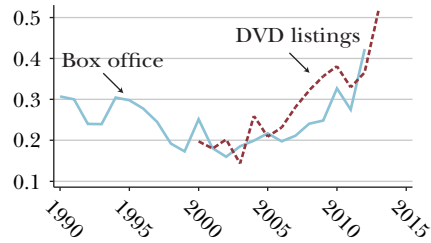
Figure 4 shows various measures of the share of successful products accounted for by products that apparently were perceived as having only modest promise, because they were not produced by the traditional media gatekeepers. In the recorded music industry (panel A), the share of top-selling albums released by independent labels grew from about 12 to 35 percent between 2000 and 2010 (Waldfogel 2015). The motion picture industry has seen a similar transformation, as shown in panel B: between 2000 and 2012, the share of box office and DVD revenue accounted for by independent movies grew from 20 to about 40 percent (Waldfogel 2016). In the book industry (panel C), between the appearance of the Kindle in 2007 and 2014, the share of best-selling books that originated as self-published works grew from zero to over 10 percent. In the romance category, the share topped 40 percent by 2014 (Waldfogel and Reimers 2015). In television (panel D), the share of the shows originating outside of the traditional sources (major broadcast networks

Figure 4
The Share of Expected Losers among the Actual Winners

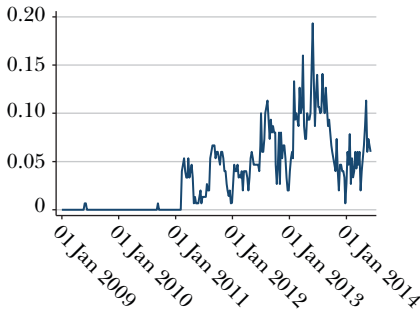
A: Independent labels' share among music



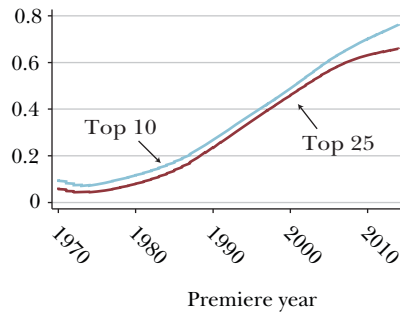
B: Independent's share of theatrical and DVD revenue



C: Self-published share among bestselling books



D: Nontraditional share among top TV



Sources: Panel A: Waldfogel (2015); panel B: Waldfogel (2016a); panel C: Waldfogel and Reimers (2015); panel D: Waldfogel (2017).

or HBO) among those shows rated most highly, grew from under 10 percent in 1970 to about 75 percent by 2010.

In short, in all four industries, the expected losers have rising and now substantial shares. These patterns are consistent with the belief that many of the new media products that are valued and purchased by consumers would have been unavailable to consumers absent digitization.

Quantifying the Welfare Benefit of Digitization

How large are digitization's benefits to consumers? The conventional "long tail" view of digitization of the media industries focuses on retailing. Rather than the small number of book, movie, or music titles available to consumers at a local bricks and mortar store, online retailing allows consumers access to essentially all extant products. This has clearly delivered large benefits to consumers, particularly those facing limited offline choices; and as noted earlier, Brynjolfsson, Hu, and Smith (2003) estimate that US consumers derive \$1 billion in annual additional consumer surplus from access to the full online, rather than the limited offline, book choice set.

But there is another way to think about digitization's benefit to consumers. By reducing the cost of bringing new products to market, digitization has enabled entry of large numbers of new products. Because product quality is unpredictable, some of these new products have turned out to be quite good. Aguiar and Waldfogel (forthcoming) quantify the size of the welfare benefit arising from a tripling in the volume of new music releases associated with this "random long tail" in recorded music, estimating it to be roughly 20 times larger than simply the benefit of giving consumers access to a longer tail of low-value products.

The intuition behind the finding works like this. If the quality of new media products were completely predictable at the time of green-lighting decisions, then a cost reduction that, say, tripled the number of new products would benefit consumers. But the benefits would be small, in the sense that all of the new products would be less appealing than the least-appealing product that was previously viable. The benefit would be equivalent to the benefit of getting access to, say, a large number of low-demand products too unpopular to be stocked at local stores.

Suppose instead—and in line with how creative products work—that producers cannot perfectly predict the appeal of creative products at the time of investment. Then a cost reduction that triples the number of new products brought to market will bring forth a range of product qualities, some good, some bad. If we order products according to their expected appeal before production, then some of the "ex ante losers" turn out to be "ex post winners"—that is, products that would not have made the gatekeepers' cut to be produced before digitization turn out to be highly desired by consumers. Indeed, given this unpredictability of appeal for media products, we estimate that the bottom two-thirds of new music products according to expected appeal accounts for about 20 times more sales than the bottom two-thirds of products according to actually realized appeal for consumers. Hence, we conclude that the additional products made possible by digitization, which randomly includes a large number of expectation-beating entries in quality, is large compared to the conventional long tail that just offers more choices, and that as a result, digitization has had a large effect on the welfare of consumers.

Two other aspects of the welfare effects of digitization bear discussion. First, digitization has a separate effect operating through reduced costs of maintaining inventories. The unpredictability of product appeal made retailing expensive prior to digitization. The music-, movie-, and bookstores needed to stock products for which demand might or—more often—might not materialize. With digital distribution, consumers have access to large selections without requiring a costly-to-maintain retail sector. Further distribution is global: consumers everywhere get access to most of the same products.

Second, despite the benefits of digitization operating through the creation of more and sometimes better products, the additional products bring with them an additional cost of discovering which of the new products are worthy of attention. This cost is exacerbated by the fact that cultural products are experience

goods. More research is needed in this area, but some comments are in order. First, it is not clear, even with many more products, that social product discovery costs have risen. In the case of music, product discovery traditionally operated through songs being aired on radio; an entire radio station audience (of, say, 100,000 listeners) needed to sample a song each time the station aired it. After airing a song, say, 10 times, a station might learn whether the song would be appealing to its listeners. With those hypothetical numbers, the cost of testing that song would be 1,000,000 listens. In the digital environment, by contrast, song sampling can occur one listener at a time; and it's possible that a song could be "discovered" to be appealing (based on listening occurring at streaming sites) based on far fewer listens. Even with far more products coming to market, the social cost of product discovery may have fallen. Having said this, it is also possible that product discovery in media markets is subject to informational cascades (Bikhchandani, Hirshleifer, and Welch 1998), in which products that get off to a strong start develop a "cascade" of positive feedback that carries them forward—and vice versa for products that get off to a slower start. Recent empirical work documents patterns of observational learning in music markets (Newberry 2016).

Digitization and Revenue Opportunities

In addition to reducing the cost of bringing new products to market, digitization has also created some new revenue opportunities. First, by turning creative works into zero marginal cost media products, digitization has facilitated the use of bundled selling arrangements. Second, zero marginal cost distribution has also, in some media industries, created revenue opportunities from the sale of complements to the digital products, such as live musical performances.

The Promise of Bundled Sales of Zero Marginal Cost Products

One effect of digitization when applied to media products is that the marginal cost of serving another consumer falls essentially to zero. When this change is combined with the ability of people to access media products on a wide range of home and portable devices, digitization enables a new range of sophisticated sales and pricing strategies, which at least in theory could bring revenue benefits to sellers. Here, we will particularly focus on the possibilities of bundled sales strategies, which have particular advantages when 1) products have zero marginal costs, and 2) consumers' valuations of products are not (perfectly) positively correlated. The media products discussed here have these characteristics: all can be digitally transmitted at essentially zero marginal cost, and different consumers attach high value to different products.

In the music industry, sales of downloaded music seemed to take off in 2003 when Apple's iTunes Music store launched, charging a uniform \$0.99 price (for most content in the United States). Starting in 2009, the store moved to three

tiers at \$0.69, \$0.99, and \$1.29 (Apple 2009). Both theory (such as Bakos and Brynjolffson 1999) and empirical research on music (Shiller and Waldfogel 2011) had suggested the promise of more sophisticated pricing strategies for digital products, and there has been a move recently to bundled content through music-streaming services. For example, Spotify, which offers bundled access to a wide variety of music, has grown from 0.5 million paid subscribers in 2010 to 50 million paid subscribers in March 2017 (see <https://www.statista.com/statistics/244995/number-of-paying-spotify-subscribers/>).

Video—in the form of both movies and television—is now commonly distributed to the home market in bundles. Netflix is perhaps the most prominent example, digitally delivering 4,210 movies and 798 television series in the United States for as little as \$7.99 per month (see https://www.justwatch.com/us/provider/netflix?content_type=show). While Netflix has a reasonably large library of already-existing movies and shows, it includes relatively few recent blockbusters. Netflix has begun to produce original programming, such as *House of Cards* and *Orange Is the New Black*. Platforms such as Hulu and Amazon's Prime service also offer bundles of programming for flat fees.

Providers are experimenting with book bundles as well, including Amazon's Kindle Unlimited service, as well as Scribd and other services.

Whether a combination of bundling and streaming stimulates or depresses other recorded music revenue is an important topic for the content industries. Concerned that their payments from streaming on Spotify would not compensate them for depressed album sales, the biggest-selling artists of the past few years—Taylor Swift and Adele—withheld their new albums from Spotify. While Spotify includes a massive library, these prominent defections raise the possibility that streaming services often offering bundles will exclude new, high-value content. This pattern is common in media industries: for example, movies first show in first-run theaters and then in second-run theaters, and then become available online. Books first appear in hardcover editions, and later in paperback. It is possible that streaming services will be part of a similar pattern of inter-temporal price discrimination, as a mode of distribution and source of revenue after the willingness to pay of high-valuation consumers has been harvested. Various recent papers have documented that streaming does displace sales: for example, Wlömert and Papies (2016) use individual-level survey data, and Aguiar and Waldfogel (2015) use aggregate data. Overall, impacts of streaming on rights-holder revenue depend on per-stream payments, which are the subject of ongoing industry discussions.

Recorded music and live music are complements in the view of many fans. The ability to distribute digital copies of recorded music at zero marginal cost raises the possibility of using recorded music as advertisements for live performances. Mortimer, Nosko, and Sorenson (2012) document that digitization stimulates concert ticket sales, at least for relatively obscure artists. Connolly and Krueger (2006) document that concert ticket prices have risen since digitization.

Conclusion

Digitization arrived to many industries as revenue-reducing bad news. Yet the main effect of digitization—even in the industries such as music, which has seen a catastrophic decline in revenue—has been to reduce the cost of bringing new works to market. While it may be true that some industry participants face challenges from digitization, such as traditional major labels, studios, and publishing houses, it also seems clearly true that consumers are now awash in products that they find desirable. To put it succinctly, digitization has ushered in a golden age of music, movies, books, and television programming.

While the early views of digitization's effect on consumers in media markets—adding access to the long tail of existing products—is correct, and these welfare gains are substantial, the effects of digitization on production are even more substantial. The lessons about the impact of digitization on the benefits from new products may have application outside of media markets. Whenever the appeal of new products is unpredictable, reduction in the cost of bringing new products to market holds out the promise that new products will deliver substantial improvements. New product quality is understood to be unpredictable in many industries, so these ideas may apply more broadly.

Much of the public policy response to digitization has concerned methods for curbing piracy, ostensibly because piracy threatens continued investment in content. While it is clearly correct in principle that threats to revenue, all else constant, stand as threats to continued content creation, it is also true that threats to revenue in media industries have been accompanied by reductions in cost. Assessments of whether copyright is fulfilling its function require more than documenting that revenue has fallen. Instead, assessments of copyright should be based on the evidence of new content creation. There can be good reasons to enforce rules against piracy; after all, stealing is illegal. But a crisis in realized creative output since 1999 should not be among the reasons cited for strengthening effective intellectual property protection for media products.

The topic of digitization and its effects on content industries is a fertile area for further research. Among the particularly important questions are product discovery, which refers to the ways in which consumers sift through the large number of new products to find those that they find appealing, as well as the effects of global distribution (for example, via Netflix, Amazon, Spotify, and iTunes) on the supply of new products and the possible convergence of consumption across places.

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