CINEMATIC EXPLOSION: NEW PRODUCTS, UNPREDICTABILTY, AND REALIZED QUALITY IN THE DIGITAL ERA*

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While file sharing has undermined firms' ability to generate revenue for their products, other technological change has reduced entry barriers in cultural industries, with substantial positive impacts on the availability of new books and recorded music. Unpredictability of product quality is a generic feature of cultural goods, including music, books, and movies, so an infusion of new products holds the possibility of bringing not just low-appeal products but also new products that consumers find highly appealing. This paper explores the effects of reduced costs of production, promotion, and distribution in the motion picture industry, asking four questions. First, we document substantial growth in the number of movies brought to market, particularly since the early 2000s. Second, we document growth in institutions by which consumers can discover new movies, many of which are produced outside of the major studios and not released in theaters. Third, we show that the new independent movies account for a growing share of commercially successful movies. Finally, we present evidence, based on both critical assessments and usage, that recent vintages are more appealing to consumers than earlier offerings. These findings on movies echo developments documented elsewhere for recorded music and books.

I. INTRODUCTION

The spread of the Internet has brought challenges and opportunities to media industries. First, the appearance of Napster, BitTorrent, and other file-sharing technologies undermined firms' ability to charge for their products, with large depressing impacts on recorded music revenue and implicit and explicit threats to other industries.[1] But technological change has also had a second effect, reducing entry barriers in cultural industries, with substantial positive impacts on the production of music and books.[2] New technologies for both creation and distribution, along with new avenues for promotion, have enabled significant growth in the number of new cultural products available to consumers.[3]

One would expect lower costs of bringing media products to market to result in more new products. But it is not obvious that a profusion of new products would deliver substantial benefits to consumers. The new products made possible by reductions in entry costs are, by definition, the products with expected revenue below the prior entry cost threshold. If the commercial appeal of cultural products were perfectly predictable at the time of investment, then new products enabled by cost reduction would deliver only modest benefits to consumers. In reality, however, the appeal of cultural products is widely understood to be unpredictable.[4] According to industry accounts, only 5-10 percent of books and records are successful. Recent research documents growth of new products that has delivered substantial benefits to consumers in the recorded music and book industries. Has the movie industry experienced a similar phenomenon?

Traditionally, it has been very expensive to make motion pictures. In recent years the major Hollywood motion picture studios reported an average production budget of $100 million to make a movie. Technological change has reduced the costs of producing, distributing, and promoting new movies. Inexpensive digital camera have lowered production costs, new online distribution channels have broken the bottleneck of theatrical release, and the Internet has supported substantial growth in film criticism such that more movies now get formally reviewed and – related – more movies get rated publicly by viewers.

Screenwriter William Goldman famously wrote that “nobody knows anything” about which movies will succeed.[5] Statistics bear out his observation. While higher-investment movies tend to attract larger audiences, the predictive power of the relationship is weak. Industry sources acknowledge that perhaps a tenth of projects generate enough revenue to pay for themselves.[6] The unpredictability of movies’ appeal raises the possibility that a growth in the number of movies brought to market might substantially increase the surplus generated by movies. More “draws from the urn” could result in more winners.[7]

The goal of this paper is to explore these possibilities, in particular asking four questions. First, has there been a growth in the number of low-ex ante appeal movies produced outside the traditional studios? Second, do consumers have ways to learn about the profusion of new independent movies, many of which are not released in theaters? Third, do the new independent movies with low ex ante appeal account for a growing share of the ex post successful movies? Fourth, has the growth of new products increased the realized appeal of the recent movie vintages to consumers? To these ends the paper assembles evidence from a variety of sources, proceeding in five sections after the introduction. Section II provides some background on the movie industry, technological change, and how this change could affect movie production. Section III describes the various data sources used in the study. Section IV provides evidence on new products. First, I provide evidence on the growth in movie production over time – and particularly since the development of low-cost production and distribution channels. Second, I document the changes in distribution and promotion of movies over time, showing that consumers have access to, and information about, a growing number of new movies. In section V, I show that independent film makes up a growing share of what consumers and critics find valuable in the movie industry's output. I then turn, in section VI, to evidence on the evolving quality – and service flow – of new movies. I present evidence that recent vintages with more movie releases also generate more appeal for consumers.

I. BACKGROUND

Movie making has traditionally required at least three capabilities: production, distribution, and promotion. The need to have all, or at least many, of these capabilities under one roof has made tended to keep movie making concentrated in a small number of "major" film studios. These are the member studios of the Motion Picture Association of America (MPAA). Traditionally, the major studios produced movies which they released widely into theaters, generally on 500 screens or more. At release, these movies were generally reviewed by critics associated with major media outlets. The studios also advertised their new movies, chiefly on television.[8]

Digitization has changed many features of the environment. First, digitization has revolutionized production. Cameras capable of recording high fidelity video have fallen substantially in price over the past few years. Prior to 2000, movies were shot on film using cameras that were very expensive. While Hollywood studios tended to rent their cameras from Panavision, sources indicate that such cameras cost roughly a quarter of a million dollars. After 2000, digital motion picture cameras began to appear that were substantially less expensive than the film cameras film makers had previously been using. By 2008 one could purchase a camera capable of shooting professionally quality high definition video for $2,000, and film makers took advantage of this opportunity. For example, Ed Burns "produced 2011's "Newlyweds" for

$9,000 using a Canon 5D Mark II and three lenses..."[9] The availability of high-quality cameras at low-cost put the technical possibility of film making into the reach of many people outside the major studios.

Home video and television existed alongside theatrical distribution long prior to digitization. As early as 1985, theatrical box office accounted for only a quarter of Hollywood revenue.[10] Yet, the more recent wave of digitization – the development of the Internet – has brought new channels of distribution, including a la carte services such as Amazon Instant Video, the iTunes Movie Store, Comcast onDemand, and Vudu, as well as bundled streaming services such as Netflix and Amazon Prime.

Filmmakers can release movies direct to video, available through such platforms as Netflix, iTunes, onDemand, and Amazon itself. These platforms differ in their degree of curation. Amazon is unfiltered and offers the simplest avenue to distribution. Distribution through Netflix or iTunes is more difficult to obtain. It is clearly easier to make a movie available to audiences than it was prior to digitization.

Making a movie available to consumers without also promoting awareness of the movie does little to generate revenue. Getting a movie reviewed by mainstream media outlets has historically required a theatrical release, and the traditional journey of highly successful movies has begun with theatrical release. One approach – for conventional major-studio movies – is large-scale theatrical release in 500 or more screens, accompanied by television advertising. A second theatrical approach is limited release, on as few as a single theater screen. These movies are often reviewed in some mainstream outlet. *The New York Times* has among the most extensive movie reviews of any US general interest publication and produces about as many movie reviews as movie released into theaters per year. The specialized entertainment publication *Variety* reviews over 1,000 movies per year.[11]

Movies not released in theaters are generally not reviewed in mainstream publications, but the Internet has supported the dissemination of reviews by bloggers and out-of-the mainstream publications. The site IMDb links to reviews by hundreds of critics, ranging from critics at *The New York Times* and *The New Yorker* to obscure bloggers. IMDb users also can review movies, as well as rate movies on a 10-point scale. Thousands of users do this.

The main question in this paper is whether growth in the production of films with modest ex ante prospects can have big effects on consumers, given that quality is unpredictable. Tests of this proposition require a way of determining which movies have modest ex ante prospects. We do measure this by whether films are "independent." Yet, defining independent film is not straightforward. One possible definition concerns the source of financing. The Independent Film and Television Alliance (IFTA) defines independent film according to whether it is "financed primarily from sources outside the six major U.S. studios."[12] The sponsors of the Film Independent Spirit Awards, a major award for independent film, provide a second definition. They define independence by "uniqueness of vision, original, provocative subject matter, economy of means, and percentage of financing from independent sources." To them, films "fully financed by a studio or an 'indie' studio division may still be considered independent if the subject matter is original and provocative." [13] Indiewire, a major online source of new about independent film employs a third definition, including "specialty films that opened in limited release (initially under 500 screens)." By limiting independence to movies predicted to have limited appeal, the Indiewire definition of independent film is inherently biased away from finding significant impact of independent film on box office.

While each of these conceptual definitions has some merit, the only approach I can implement in a large-scale way is to define independence according to the identity of the firm producing the movie. IMDb allows to me easily identify whether one of eight major studios is a producer of a movie.[14] If so, then I define a movie as a major studio movie. Otherwise I define the film as independent. Technological change has made it easier in principle for film makers outside of the major studios to make movies and get them known by, and available to, consumers. Given the unpredictability of appeal, more movies deliver substantial benefits to consumers. Have these things actually happened? We turn now to an attempt to answer these questions, beginning with a discussion of the many and disparate data sources we employ.

II. DATA

The main dataset for this study is a list of 81,032 movies produced in the US, 1980-2013, drawn from The Internet Movie Database, or IMDb, including whether each of the movie is produced by a major studio. Ideally, we would observe revenue from all sources, as well as measures of the individual movies' appeal to critics and audiences. While the actual data fall short of the ideal, we can observe various measures of commercial success. First, I supplement the data with box office revenue for the 11,567 movies released into theaters, from Box Office Mojo, 1980-2013. Second, I observe the 13,812 movies available for a la carte streaming through Amazon Instant Video, the 19,165 movies available from Vudu, as well as the 9,658 movies available for streaming on Netflix, all in August 2013. Third, I observe the top 20 DVD rentals by week, 2000-2013 (from Home Media Magazine via IMDb). Fourth, I observe 82,517 television listings of movies on basic and premium television, 2009-2013 (from zap2it.com via the Internet Archive). Finally, I observe an indirect measure of usage for a wide group of movies, the number of IMDb users rating each US-origin feature movie at the IMDb database, 2001-2013. These measures allow me to calculate the share of revenue accounted for by independent releases in theaters and a measure of the independent share of top-selling DVDs, as well as the independent share of movies available through various distribution channels.

In addition to measures of commercial success, I observe critical and audience response to movies. I observe the Metacritic rating for 6,890 movies released between 2000 and 2012. Second, I observe the Rotten Tomatoes ratings of what they deem the top 100 movies per year 1993-2012. Finally, the detail page on each film at IMDb provides includes the list of critics reviewing the film. This list includes both professional critics of the sort covered in Metacritic and Rotten Tomatoes, as well as a large number of lower-profile bloggers. These data allow me to document whether the realized quality of movies has improved as the number of releases has grown and to explore the role of independent movies among those that are critically acclaimed.

III. NEW PRODUCTS AND THEIR AVAILABILITY AND DISCOVERY

IV(i). *New Products*

The movies that are most salient for US audiences are those released by the "major" studios that are members of the MPAA (Disney, Paramount, Sony, 20th Century Fox, Universal, and Warner Brothers). As Figure 1 shows, the number of movies released by MPAA members has fluctuated between about 150 and 250 since 1980. Recently the number of MPAA releases has been falling, and 2012 saw the fewest releases since the late 1980s. Yet, releases by the majors are a very small share of the movies made.

Figure 1 also shows two other measures of the available new products, the total number of US-origin features and documentaries listed at IMDb and the total number of movies released into theaters. The total number of movies released into theaters has grown from about 200 in the early 1980s to roughly 600 in the years around 2010. Movies released into theaters account for a small and declining share of movies produced. US-origin movie releases far exceed production of the major studios or overall theatrical releases, requiring a separate y-scale in Figure 1. Total US movie production comprised a few hundred in 1980 and grew to 2,000 just before 2000. After 2005 the number of new releases began to increase quickly, reaching nearly 7,000 in 2012. The number of movies produced annually has risen sharply since about 2003.[15]

Not all moves that are produced are released to consumers. "Release" has many possible meanings, running from being one of the 7,000 US-origin releases from 2012 listed at an IMDb page to wide theatrical release on more than 1,000 screens. An expansive measures of releases is the number of movies broadly available for sale. Amazon has the least restrictive policy for making movies available through their site, so the number of movies available at Amazon provides an inclusive measure of product availability, at least for movies that have finished their theatrical runs. Being available through a curated platform (Netflix, iTunes, etc.) provides a more restrictive measure of available products. Next in line would be limited theatrical release, followed by wide theatrical release.

Of the roughly 6,000 US movies produced in 2010, 1,230 were available for purchase at Amazon, and 1,058 were available for streaming on Netflix through their subscription service as of late 2013. Thus, more than double the 534 that had been released in theaters in 2010 were being distributed online a few years after release.

Growth in the number of movies produced has prompted a shift in the genre mix, at least outside of the most popular movies. If we restrict attention to the top 200 movies of the year (according to the number of users leaving an IMDb rating, which is highly correlated with box office revenue for movies released into theaters), we see little change in the genre mix over time, according to the first genre listed at IMDb. Action films films make up a quarter in both 1980 and 2012, comedy makes up 30 percent, and drama accounts for just under 20 percent in both years. When we look at movies overall – which includes substantially more movies outside the top 200 in 2012 – we see some changes in genre distributions: action movies make up a quarter of all movies made in 1980 but only 11 percent in 2012. Drama accounts for 18 percent in 1980 and 30 percent in 2012. The changing genre composition outside the top 200 may reflect arise because dramas are less costly to produce than action films.

IV(ii). *Product Discovery*

It is clear that online distribution channels give consumers access to far more movies than are reviewed by traditional, mainstream outlets. This begs the question of how consumers learn about these additional movies. While mainstream outlets review relatively few movies – and usually only those released in theaters - a large group of nontraditional critics reviews other movies. IMDb follows hundreds of these nontraditional critics, who include both formal reviewers such as those included in Metacritic, as well as movie bloggers. This has two consequences. First, movies tend to have far more reviews by critics listed at IMDb. Second, many movies lacking reviews from traditional outlets have reviews from IMDb-listed reviewers.

The range of critics included in IMDb is broad. For example the 2012 movie “Argo” (which won the Best Picture Academy Award), has 588 critic reviews at IMDb. The sources for these reviews run the gamut from high-profile general-interest publications such as *The New York Times* to obscure blogs. One way to characterize these sources is by the Internet traffic of their web sites. Alexa provides a traffic rank for most of the domain names on the web. I obtained the Alexa traffic ranks (as of August 6, 2013) for all of the sites that IMDb lists with "Argo" reviews.[16] For example, the *NYT* site is ranked 143 among world sites, the Washington Post is ranked 405, and Entertainment Weekly is ranked 1,651. But the median ranking of the sources providing critical reviews of "Argo" is 1.6 million. These are movie blogs maintained by individuals.

Having additional reviews for the same movies provides limited additional information. But perhaps more important is that, with the inclusion of the informal critics, more movies have review information. To explore this I obtained the number of critics listed at IMDb for the movies across a range of popularities (as measured by the number of IMDb users rating each movie), 1990-2012. In particular, I obtained the number of critic reviews for the movies ranked 1, 51, 101,…,1001 from each year according to the number of IMDb users. See Figure 2. Movies in the top 101 have essentially complete review coverage over the entire period. Movies in the next 400 have 70 percent coverage in the period 1990-1994, and coverage rises to about 90 percent later. Movies in the next group (551-751) experience dramatic increase in coverage, from about 20 percent in 1990-1994 to about over 80 percent since 2005. Finally, movies in the 801-1001 group also experience dramatic increases in coverage, from 0 in 1990-1994 to about 60 percent since 2005. It is clear that movies farther down the distribution now receive attention from critics, where they previously did not.[17]

Opinions of lay moviegoers have also become more widely available. IMDb reports a rating for each movie with 5 or more user votes (a rating on a 10-point scale). As of August

2013, the number of movies with user ratings grows from 1,500 for vintage-2000 films to about 2,400 for movies released in each year since 2005.[18] It seems clear that consumers have ways to obtain information about the appeal of many more movies than they could have a decade or two earlier.[19]

IV. SUCCESS OF THE NEW MOVIES

When product appeal is unpredictable, then the growth in new products made possible by cost reduction documented above will not only manifest itself in more products, a growing share of the products with modest ex ante prospects will also appear among the most commercially successful products. We turn in this section to this prediction, asking specifically whether movies from independent producers make up a growing share of commercially successful movies.

V(i). *Independent Share of Revenue*

We have already seen above that a growing – and now dominant – share of movies released into theaters (over 80 percent) are not produced by MPAA member studios and therefore are "independent" by our working definition. How about box office revenue? I can merge the Box Office Mojo revenue data with the IMDb list of movies from major studios to determine which movies are major and which are their complement and therefore independent. Figure 3 shows the evolution of the independent share of box office revenue, 1990-2012. Between 1990 and 1995 the independent share fluctuated between 25 and 30 percent, then fell to about 20 percent until 2005. Since 2005 the independent share measured in this way has risen sharply, topping 40 percent in 2012.

DVD sales have the potential to show the growth in independent movies more clearly than box office revenue. Many more movies are released on DVD than in the theaters. On the other hand, available data on DVD revenue cover only the top 20 by week. While it is over 1,000 listings, it translates to about 200 titles per year. It is not obvious whether the independent movies would be prominent on such a list. Still, we can merge the IMDb major variable the DVD list to see. As Figure 3 shows, the non-major share of listings rises fairly steadily from 0.2 in 2000 to 0.5 in 2012.

V(ii). *Independent Movies among Streaming Digital and Televised Offerings*

The iTunes store sells movies, and as the Ed Burns anecdote suggests, it provides an outlet for independent movies. While the current top 100 iTunes movies are available at their site, Apple does not provide data on past rankings, nor do they provide a longer list. Using data from the Wayback Machine, I have at least one hourly top 100 ranking from each month between July 2009 and July 2013. Over this period, independent movies (non-majors, according to the IMDb approach) make up a steady 50 percent of the top-100 listings.

Amazon has 13,898 US-origin feature or documentary movie titles available through its Amazon Instant Video service originally released 1980-2012. Figure 4 shows the independent share of these movies by vintage, and it rises from 40 percent for 1980 to about 90 percent in 2010.

As of August 2013, Vudu offered 19,133 movies through its streaming service.[20] Their Wal-mart interface shows the list, ostensibly ranked by sales. Hence, I have the list of movies available in August 2013 ordered by Wal-Mart's measure of popularity. I merge this list with the IMDb major studio list (which I have back to 1980-vintage movies). I can then calculate the share of Vudu-available movies of each vintage produced by independent studios. To make each year's share comparable, I restrict attention to the (currently) 50 top-rated movies from each vintage. See Figure 4. For movies originally released between 1980 and 2005 (and currently available at Vudu), the independent share hovers around 15 percent. For Vudu-available movies originally released since 2005, the independent share rises: reaching 40 percent in 2010. This is significant because the independent share among the top 50 from each vintage is rising. The Netflix streaming service carries thousands of movies. It is well known that Netflix does not carry many recent box office hits. Hence we expect independent fare to make up a large share of the Netflix streaming library. Figure 4 shows the independent share of Netflix fare, by vintage. About half of the 1980-vintage films on Netflix are from the major studios. The independent share rises steadily across vintages, to over 90 percent for movies released since 2000. While the independent share of box office revenue reflects consumers choosing indie fare over major studio fare, the share here has a different interpretation. Netflix avoids recent high-cost major studio movies, but they are able to exhibit recent movies by obtaining rights to films from outside the major studios.

One of the major revenue-generating outlets for movies is television. To see how independent studio movies fare on television, I obtained data on television schedules 2009-2013. Zap2it.com is a website the posts television schedules for about 100 distinct channels. While past schedules are unavailable through zap2it, they are archived at the Wayback Machine. Roughly once a day since 2009, the Wayback Machine has taken a snapshot of the television schedule grid. These snapshots cover three-hour periods. Movies are identifiable in these grids because they are listed with a title, followed by their vintage in parentheses. Using the archived zap2it pages available at the Wayback Machine, I am able to obtain 82,517 movie listings for

2009-2013. The channels covered include broadcast networks, basic cable, and premium cable channels. Across these years, I see 13,779 distinct movies aired on television. Movie listings remain a constant share (about 10 percent) of the overall listings that I observe.

I can merge the movies aired on television with the IMDb major studio data to see what share of televised movies are from the major studios. Figure 4 shows the complement, the independent share of televised movies. I report this by vintage of movie release, pooling all five years of television airing data. The independent share is 25 percent for 1980-released movies and rises steadily thereafter, to about 40 percent for movies released in 2000. For movies released since 2000, the increase is more substantial. Of the televised movies released in 2006-2009, two thirds are from independent studios.

V. ARE RECENT VINTAGES GOOD?

That movies from non-major studios make up a growing share of consumption in recent years shows that independent movies of each vintage are important relative to the major studios' moves of the same vintages. But this evidence does not indicate whether the recent vintages – containing the explosion of new work – are good compared to earlier vintages. Cross–vintage comparisons require a different sort of evidence.

I have two sorts of evidence that speak to the evolution of vintage "quality." First, I have critical assessments of large numbers of movies from Rotten Tomatoes and Metacritic. These outlets translate underlying critics' reviews into scalar measures that are comparable across movies (and therefore over time as well). Metacritic aggregates professional critics' movie reviews into "Metascores" ranging from 0-100. On this scale, 81-100 reflects "universal acclaim," 61-80 reflects "generally favorable reviews," 40-60 indicates "mixed or average reviews," 20-39 indicates "generally unfavorable reviews," and 0-19 means "overwhelming dislike."[21] Rotten Tomatoes similarly distills reviews into scores on a 0-100 scale. At Rotten Tomatoes, "fresh" means 60 or higher, "rotten" indicate 59 or lower, and "certified fresh" means 75 or higher with at least 40 reviews, 5 of which are from top critics.[22] Second, from the television listing data I have measures of movie usage by viewing year and release vintage, allowing me to infer the service flow of each underlying vintage.

Rotten Tomatoes lists their top 100 movies of each year for each year since 1993.[23] With some modification, I can use these lists to construct an index of high quality movies by vintage. Rotten Tomatoes rates movies on a 100-point scale. The 100th best movie from 2011, "George Harrison: Living in the Material World," earned a score of 85. The 100th best movie of 2010, "Made in Dagenham," earned an 80. Because I only observe the top 100 movies of each vintage, I don't know how many 2011 titles earned between 80 and 85; but I can see that 77 titles from 2010 earned at least an 85. Hence, I can say that the number of titles earning at least an 85 grew from 77 in 2010 to 100 in 2011.

I can use this idea across all of the years since 1993. First, I find the highest 100th-best rating across all of the years. The highest score of a 100th-ranked movie over this period is 87. Hence, I include all movies with this rating or higher across all of the available year, for a total of 1,279 titles. Figure 5 shows the evolution of the resulting index. Between 1993 and 1999 it averages about 35 titles per year. Between 1999 and 2003 it doubles. It has averaged about 80 per year since 2003, reaching 100 in 2012.

How many of the good movies at Rotten Tomatoes are independent? As Figure 6 shows, major studios accounted for the lion's share of the 1980s movies deemed best by Rotten

Tomatoes. For movies released between 1980 and 1990, roughly two thirds were from major studios. Between 1990 and 2000 the share of the Rotten Tomatoes best movies from independent studios rose from 40 percent to about 80 percent. The independent share of the best films at Rotten Tomatoes has fluctuated between about 80 and 85 percent since 2000.

That critics like a set of movies may say more about aesthetics than commercial appeal. It would be useful to know whether movies that appeal to critics also appeal to consumers. The Metacritic dataset includes both summaries of critics' reviews (the "Metascore," which is a number between 0 and 100), as well as average user ratings (on a 10-point scale). Of the 6,890 movies released 2000-2012 with Metacritic ratings, there is a clear positive relationship between user and critic ratings: movies with higher critic scores have higher user scores. A regression of the user score on the Metascore shows a highly statistically significant relationship: an additional Metascore point is associated with a 0.04 point higher user score, and the t-statistic is 43. Yet, the fit is imperfect, and the regression R-squared is 28 percent. Still, an improvement in the quality of movies in the eyes of critics – as we see in the Rotten Tomatoes data – would seem to be appreciated by lay filmgoers as well.[24]

We can draw inferences about the service flow of each vintage from consumption data a variant on the approach used in Waldfogel [2012] for measuring the evolution of the quality of music vintages over time. The approach works as follows. At any point in time, older products tend to be used less than newer ones, as products depreciate over time. But after accounting for depreciation, are some vintages used more than others? If so, then those vintages are delivering more service flow. To implement this, we would need to observe consumption by calendar year and film release vintage. For example, we would need sales or rentals of movies originally released in, say, 2008 during, say, calendar year 2010.

We do not have detailed consumption data by year and vintage, but the television listing data resemble the consumption data we would seek. In each year, 2009-2013, we observe thousands of movie listings for movies originally released in various (mostly) earlier years. For example. we have 7,917 movie listings for 2012. Of these, 168 are for movies originally released in 2012, 407 are for movies released in 2011, 528 for 2010, 511 for 2009, and so on. That older movies are aired less in any particular year reflects their depreciation. But after accounting for depreciation, which vintages have higher use?

We can assess this systematically. Define $s_{t,v}$ as the share of year t listings originally released in year v. We can regress $ln(s_{t,v})$ on age dummies - to flexibly account for depreciation – as well as vintage dummies. The coefficients on vintage dummies provide an index of vintage service flow. Figure 7 reports the resulting vintage service flow index. It falls from 1960 to 1975, then rises fairly steadily from 1975 to 2006. Although the index falls after 2006, it remains above its level prior to the mid-1990s.

Movies of the 1960s and 1970s continue to air on television a lot relative to their age, while movies from the mid-1970s through 1990 are aired less, given their ages. Movies from the vintages since 1990 air substantially more than their age alone would imply. The recent period – with its large growth in titles – seems to be a period of high annual service flow. Because the dependent variable in the regression is a log share, the interpretation of the series in Figure 7 is also in log terms. Between 1990 and 2000 the index rises from 0 to 1, meaning that the 2000 vintage is used roughly 170 percent more than the 1990 vintage, conditional on its age.[25]

VI. CONCLUDING DISCUSSION

As with books and recorded music, the movie industry has experienced a reduction in the cost of bringing new products to market, with strong ensuing growth in the number of new products available to, and discoverable by, consumers. Given the unpredictability of cultural products' appeal, growth in the number of products with low ex ante appeal – here, independent movies – has two effects that we document. First, independent movies make up a substantial and growing share of commercially successful movies. Second, the recent vintages that include substantial numbers of independent movies are appealing to audiences and critics, relative to earlier vintages. Hence, technological change reducing costs of bringing new movies to market appears to have produced substantial benefits to consumers.

The motion picture industry, in its statements to policy makers about new technology, has focused on threats to revenue arising from piracy. Hollywood studios have viewed technological change largely for its potential threat to intellectual property, raising the spectre of lost jobs and reduced movie production unless policies are enacted to strengthen effective copyright protection. Representatives of the motion picture industry express concern about whether effective intellectual property rights are strong enough to provide rewards adequate to ensure continued supply of new motion pictures. While a concern about diminished supply of new movies seems valid in principle, the recent experience of the movie industry suggests that the flow of new products is robust and rising.

Figure 1

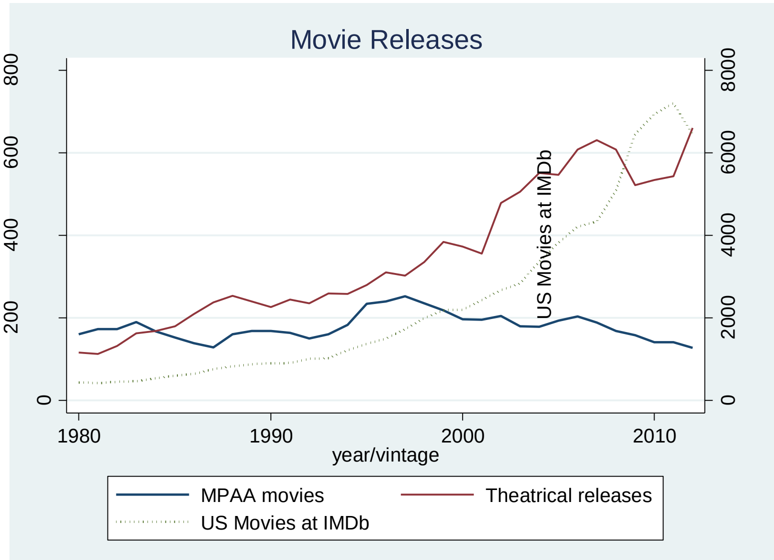


Figure 2

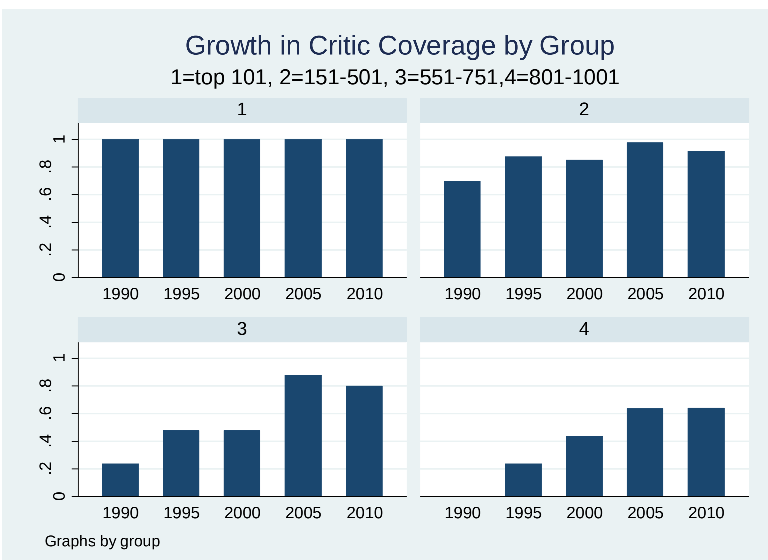


Figure 3

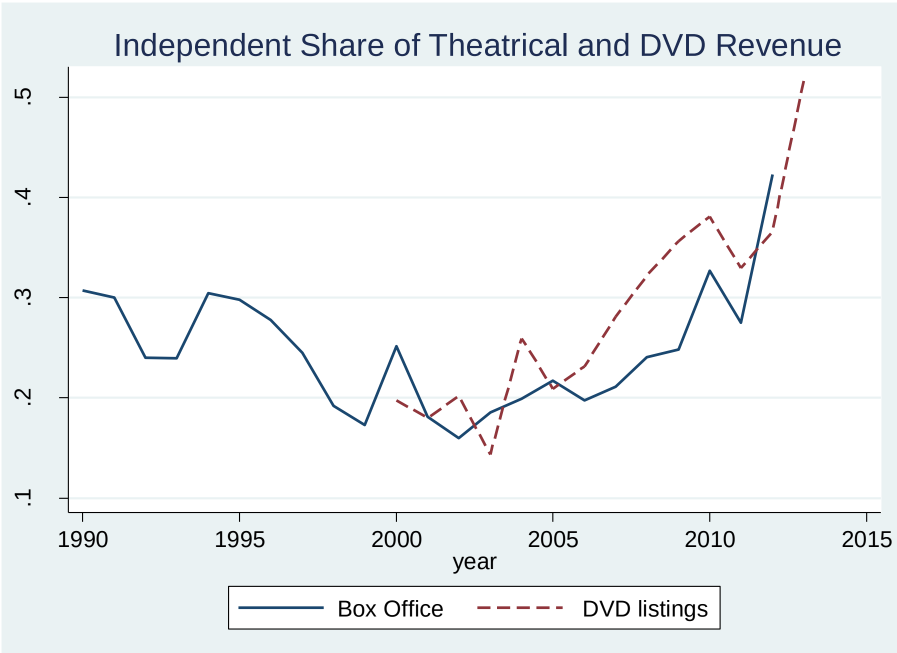


Figure 4

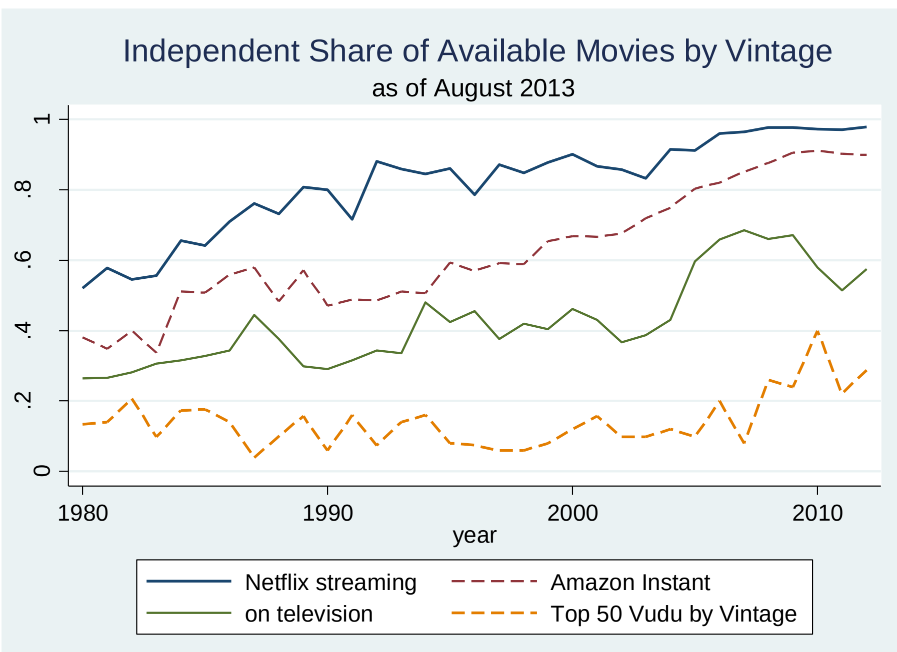


Figure 5

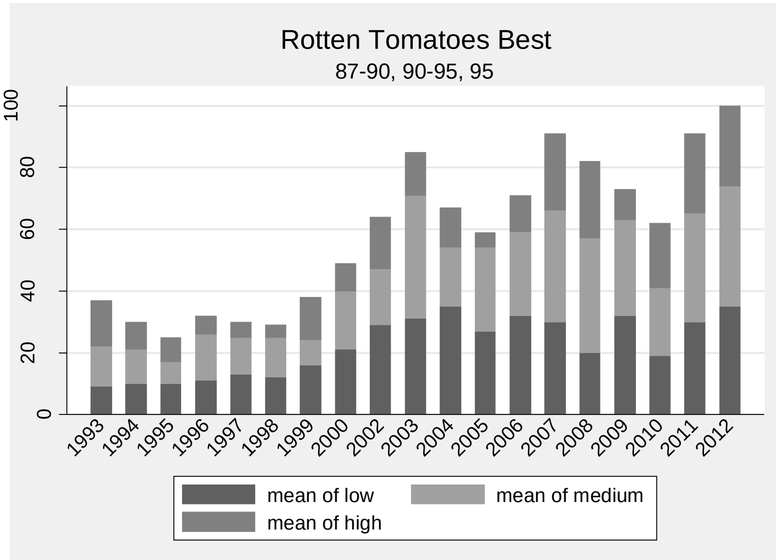


Figure 6

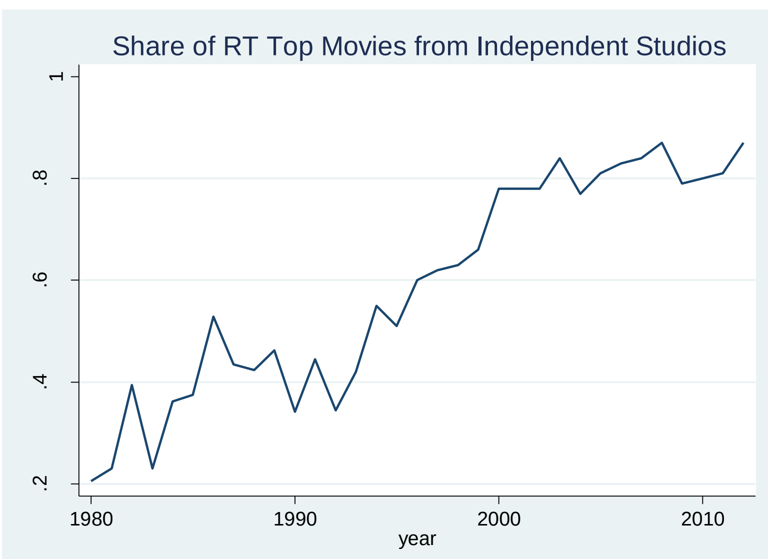
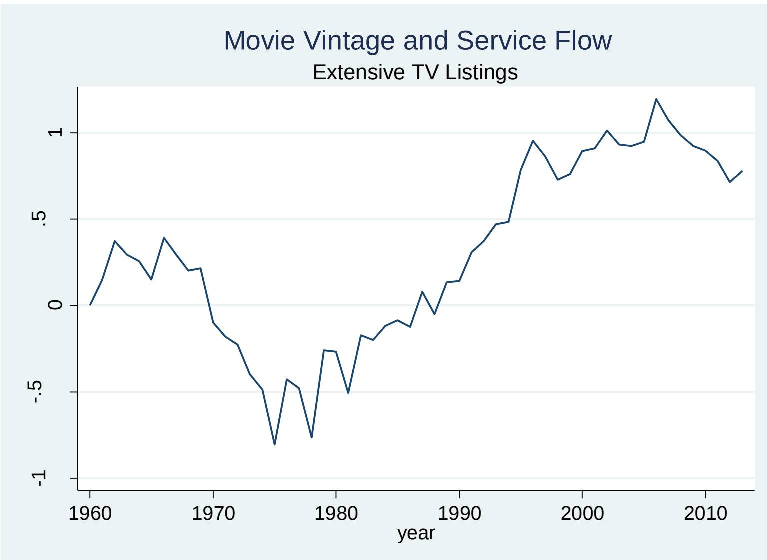


Figure 7


Movie Vintage and Service Flow
Extensive TV Listings
-1
-.5
0
.5
1
1960
1970
1980
1990
2000
2010
year

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[1] See the empirical piracy literature: Oberholzer-Gee and Strumpf [2007], Leibowitz [2006], Rob and Waldfogel [2006], and Zentner [2006], among others.

[2] See Waldfogel [2013] and Waldfogel and Reimers [2013].

[3] See also Handke [2006, 2012] and Oberholzer-Gee and Strumpf [2011].

[4] DeVany and Walls [2004] provide systematic evidence on the predictability of movie revenue.

[5] See Goldman, William [1989].

[6] See Caves [2000], Vogel [2008], and McKenzie [2012] for background on the movie industry.

[7] See Tervio [2009] for a model that incorporates this mechanism.

[8] According to Marich [2011], "the centerpiece of ad campaigns remains TV, which gobbled up 73% of movie advertising dollars in 2010." (http://variety.com/2011/film/news/tube-ties-up-studio-bucks-1118041256/)

[9] http://www.usaweekend.com/article/20130201/TECH/302010013/Talking-tech-actor-director-Edward-Burns

[10] http://www.edwardjayepstein.com/MPA2007.htm

[11] In 1999, the New York Times produced 424 reviews, and 385 movies generated box office revenue. See http://movies.nytimes.com/ref/movies/reviews/years/rev_year_1999/index.html?srw=101 and http://www.boxofficemojo.com/yearly/chart/?yr=1999&p=.htm . See http://variety.com/v/film/reviews/ .

[12] See Fee [2012] for, among other things, a discussion of independent vs studio movie finance.

[14] Distinctly searchable film producers at IMDb include 20th Century Fox, Sony, Dream Works, MGM, Paramount, Universal, Disney, and Warner Brothers.

[15] One might worry that growth in the number of movies listed in IMDb could confound actual growth in creative effort with growth in coverage. As one check against this possibility, I obtained another measure of creative output, submissions of films to the Sundance Film Festival. Sundance submissions have a modest fee ($50 in 2014). Submissions rise from 1,285 in 2004 to 2,021 in 2008. This provides some outside confirmation of an actual increase in movie production during the 2000-2010 decade rather than a reporting anomaly.

[16] See http://www.imdb.com/title/tt1024648/externalreviews?ref_=tt_ov_rt .

[17] A look at the full distribution of critical reviews for the 2,900 US-origin features released in 2012 confirms this. Of these releases, 325 were reviewed at Metacritic. By contrast, 916 of these movies have at least one critical review in IMDb, 760 have at least two critical reviews, 681 have at least three, 572 have five or more, 417 have over ten, 286 have over 25, 206 have over 50, 171 have over 75, and 152 have over 100 critical reviews.

[18] I include only releases since 2000, the period when IMDb users have been most active.

[19] While the user-generated reviews at IMDb are potentially subject manipulation of the sort documented in Mayzlin, Dover, and Chevalier [2012], the reviews from specialized movie bloggers with reputational concerns appear to be less susceptible.

[20] I obtained the list of movies at Vudu using the Wal-Mart interface: http://www.walmart.com/cp/Top-VUDU-Rentals/1087908.

[21] http://www.metacritic.com/about-metascores

[22] http://www.rottentomatoes.com/about/

[23] They list top movies for earlier years, but the earlier lists include fewer than 100 titles per year.

[24] The Metacritic data can also be used to create an index of movies above a particular Metascore by year. However, Metacritic's coverage is limited to movies released in theaters and so cannot reflect movies with non-traditional release.

[25] I obtain 170 percent as 100*($e^1 - 1$).