Netflix and Blockbusters: Streaming's Disparate Impact on the Box Office*

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Abstract

Streaming platforms have recently emerged as a mode of distributing new movies, bypassing the traditional route of a theatrical release. We study how the emergence of Netflix as a platform offering new movies, impacted theatrical movie consumption. Using movie-level box office data from several countries from 2007-19 and a difference-in-differences strategy that exploits a wide variation in Netflix penetration across countries, we find no conclusive evidence of streaming movies impacting the total revenues at the box office. However, we find a significant positive impact on the box office share accrued to top movies (blockbusters), an increase in concentration. We verify that the effect is not driven by any notable changes in production (supply side) decisions and document a significant overlap in genre composition between Netflix and movies ranked lower at the box office (compared to blockbusters). The results have significant implications on movie production and distribution decisions.

Keywords: Video Streaming, Motion Picture Industry, Concentration, Disruptive Technology

JEL Codes: D12, L82, O33, Z11

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1 Introduction

Streaming services have emerged as a popular mode by which households consume entertainment programs, as internet adoption has steadily increased around the world. In the U.S., major broadcast networks have started their own streaming services, leaving little doubt that streaming can be seen as the future of home-based program consumption. Starting 2016, Netflix began offering new movies for consumption via its platform and increased its offering in every subsequent year. While the service's decision to offer movies may seem natural, it is a significant change in movie distribution.

Getting audience to theaters is the original mode of distributing motion pictures. While the advent of television brought the ability to consume movies from home and subsequent inventions like VHS and DVD improved on it, theatrical exhibition continued to be the major source of revenue to its producers and the mode of choice for distributing them to its highest valuing customers. Before the emergence of Netflix with its catalogue of direct to home movies, direct distribution was associated with movies produced at a low cost, with little overlap of cast-members who work at the major theatrical releases. In other words, movies that were unlikely substitutes to theatrical viewing. With streaming, there is now a superior availability of new movies, directly at homes with the potential to impact viewers' theatrical choices. Understanding the nature and magnitude of this impact is the focus of our paper.

We exploit the fact that Netflix, the leading provider of streaming service had achieved significant penetration in the United States but much less in most countries in Europe in 2015, when it began offering new movies on the platform. We estimate the impact through a difference in differences strategy by comparing box office numbers in the U.S. to the control countries in Europe, to find no noticeable impact on the total box office revenues. In other words, the availability of Netflix movies did not diminish viewers' aggregate theatrical consumption. The result points to the importance of theatrical consumption as a social activity in the U.S., not readily substituted by the increased availability of movies at homes.

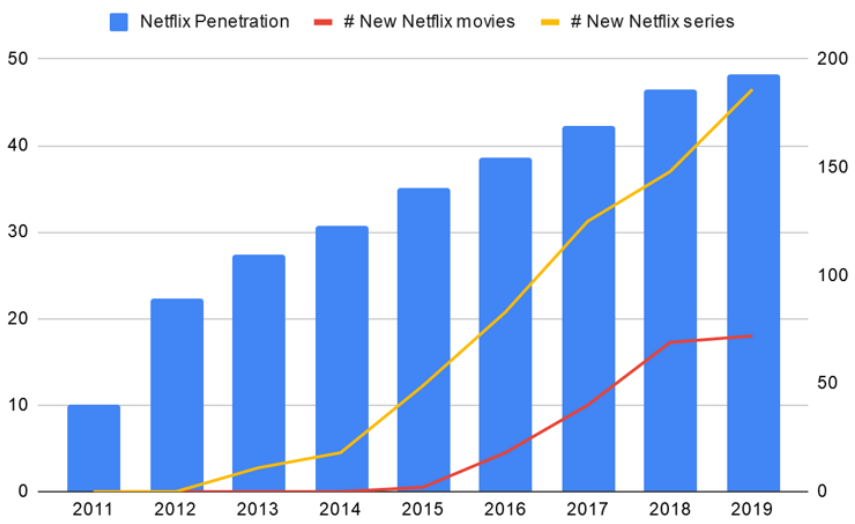


Figure 1: Netflix penetration is an estimate of the proportion of households with access to Netflix (Netflix subscriptions divided by total households). New Netflix movies and series are counts of English language movies and TV series respectively, that were exclusively released on the platform; their counts are on the alternative y axis.

The result also points to an expansion of movie consumption in the U.S. during 2016-19, with the advent of streaming movies.

We also find an increase in the share of box-office revenues of blockbuster movies with the advent of streaming movies. We estimate that, on average between 2016-19 the share of total box office revenue garnered by a movie ranked top 10 at the box office went up by approximately 6.6%. An increased concentration conveys how an increase in choice and availability of movies at home has led to viewers making more popular choices for theatrical consumption perhaps trading off a more closer match for their tastes. The results presented here are economically important and provides insight regarding the theatrical impact of streaming. We provide some additional analysis to support that the increased concentration is indeed driven by viewer choices and not supply side changes.

2 Literature

The economics of digitization literature has a rich history in undertaking investigations of technology linked innovations. More recently, the field has investigated how the adoption of technology platforms like Uber and Airbnb have disrupted traditional services (e.g., Zervas, Proserpio, and Byers, 2017) and others have studied their society wide impacts (e.g., Greenwood and Wattal, 2017; Burtch, Carnahan, and Greenwood, 2018; Babar and Burtch, 2020). As one of the earliest papers studying the impact and nature of streaming services on movie consumption follows this line of work. While streaming of scripted original programs is more recent, features of streaming video like on-demand availability (Belo et al., forthcoming), binge watching (Godinho de Matos and Ferreira, 2018) and how they affect viewer consumption, has been studied in the field; we add to this budding literature that aims to formalize how streaming video affects content consumption. Other technological advances have impacted theatrical distribution of movies and have been subjects of study; notable among them are the studies on the impact of digital piracy (Smith and Telang, 2009; Danaher et al., 2010) and the studies on the impact of online reviews (Gopinath, Chintagunta, and Venkataraman, 2013; Chintagunta, Gopinath, and Venkataraman, 2010). Availability of detailed box office data has seen empirical studies of theatrical exhibition like Einav (2007)'s investigation of seasonality in movie watching. Rao and Hartmann (2015) investigates how the ability to make available additional copies cheaply (due to digitization), influences exhibitors' incentive to become multiplexes and trade-off screen size (quality) for flexibility. When streaming services like Netflix provide original content, viewers face this same quality flexibility trade-off, only more acutely. Our work, is an empirical investigation of the effect of this trade-off at the box office. There is a nascent literature (Belleflamme and Paolini, 2019; Cabral and Natividad, 2020) that studies how the breadth of a movie's appeal is linked to its release strategy. It is optimal for movies with the widest appeal to release when audience demand is high but optimal for movies with comparatively narrower appeal to release in a period where audience demand is comparatively lower. We show (here)

that the implications of streaming content too is different for movies based on features that determine their theatrical demand.

3 Empirical Strategy and Data

3.1 Empirical Strategy

Our goal is to study how the emergence of streaming content, especially new movies distributed via streaming services impacted the box office. A randomised experiment to study the impact of streaming on movie going is implausible as this would involve not only randomly assigning subjects access to streaming services but also studying their movie going behaviour for an adequately long period. This brings us to exploring natural experiments where some exogenous factor may have shut down the access to streaming services in a region when other regions continued to have the service. The two most popular streaming services—Netflix and Amazon Prime Video are not known to have faced any disruptions of their service for a noticeable period, thereby ruling out the option of exploiting a quasi-experimental research design.

Our identification strategy draws on the significant difference in Netflix penetration between the U.S. and countries (see fig. 2) in Europe to study streaming's box office impact. Netflix launched their streaming service (in the U.S.) in 2007, became a distributor of original content starting in 2013 and emerged as a platform distributing new movies in 2016. Between 2016-2019 Netflix is the only major streaming service distributing new movies (see fig. 11). Netflix is the most popular streaming service and has the highest subscribers in all countries considered here. While the service was by then subscribed by 38% of US households, except for the U.K., it had relatively low penetration in the major European countries viz. Germany, Italy, France, Spain and Russia. In France, only eight percent households had access to the service (in 2016) and in other countries an even lower proportion (see Figure 2). If movie consumption via streaming is a substitute for movie going, it should affect the

Netflix Coverage: Proportion of Netflix Subscribing Households

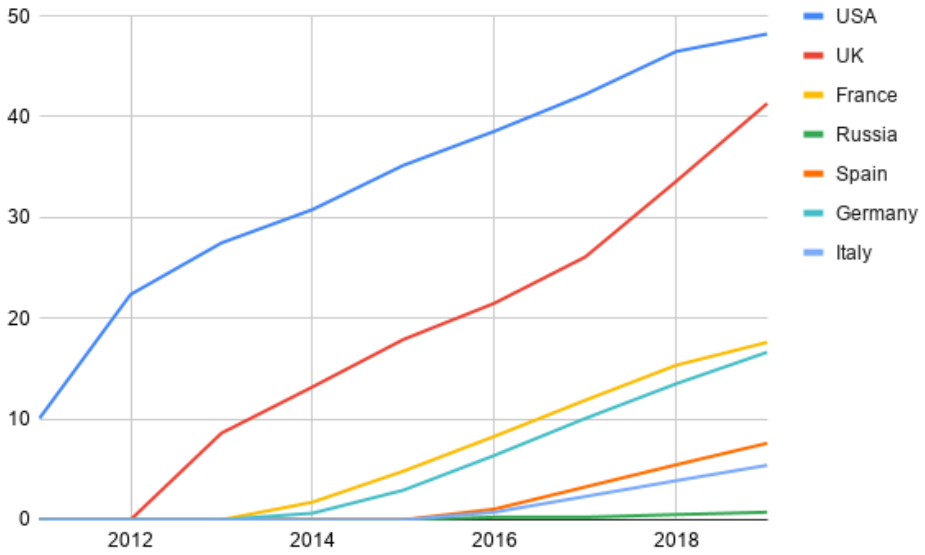


Figure 2

box office revenues in the U.S. where it is widely available but not in the European countries where the service's penetration is relatively scant between 2016-2019. Any change, in the difference between the box office revenues of U.S. and the control countries since 2016 (compared to before), needs serious consideration as the impact of streaming content (especially new movies) on the box office.

3.2 Data

Our strategy is to compare theatrical revenues of movies exhibited in the U.S. to those in the European countries, before and after Netflix began to offer original movies. We obtain data on box office revenues of movies released in six major European countries (U.K., France, Italy, Germany, Spain and Russia) and the U.S. through the years 2007 to 2019. The data is obtained from Boxofficemojo.com, a website known for the most systematic tracking of box office revenues, a subsidiary of IMDB. A glance at Fig.2 tells us that Netflix started offering new and exclusive movies in 2016 and original content (notably) since 2015. Any impact on theatrical revenues will occur starting around year 2016, a period well covered by our data.

In Fig 3 the data is summarized by country.

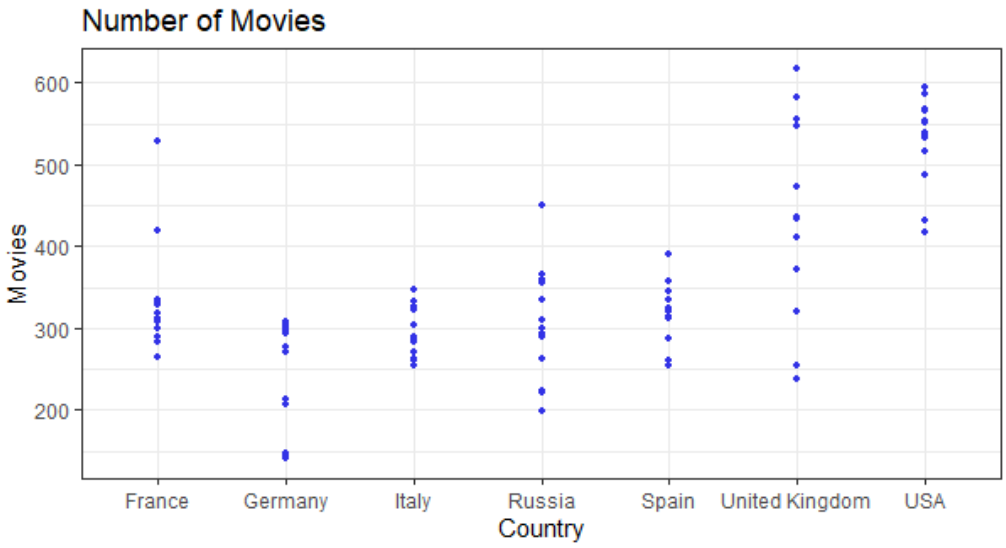
We can notice some variation in the number of movies for a given country, across years. This can lead to slight concerns regarding whether our data has missing observations. In part (b) of fig.3 we plot the share of B.O. revenues accruing to the highest grossing 200 movies. Notice that these top movies accounts for above 95% of box office revenues in every country-year. Any missing movies, as long as they come from the tail of the distribution, is unlikely to underestimate the total box office revenue generated in the country-year notably to affect our strategy.

3.3 Specification

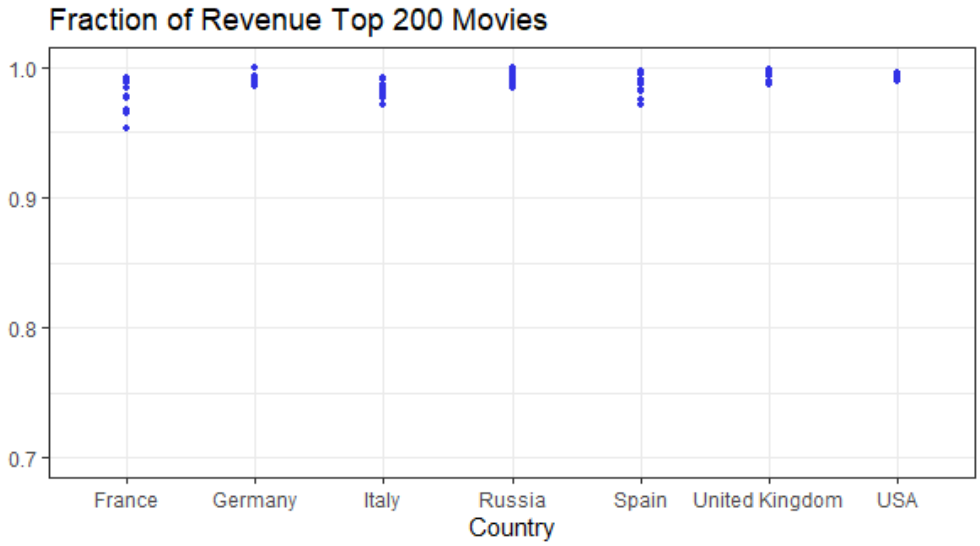
We need to test for a change in box office collection in the United States coinciding with Netflix offering original movies relative to the control countries, leveraging the panel structure and substantial variation in Netflix penetration. This setting lends itself to a difference in differences framework; compare the differences in box office between U.S. (where Netflix penetration is high) and control countries in Europe (with the exception of U.K.) where Netflix (where Netflix penetration is low), before and after the onset of streaming. The noticeable difference in Netflix penetration (percentage of households subscribing to the service) creates treatment and control units.

For a given movie which was ranked ith in country c in year y we have $R_{i,c,y} > 0$ as the outcome variable. The focal independent variable is an interaction of $netflixmovies_y$ the number of Netflix original movies in year y with an indicator variable for the observation being from the U.S. We consider a movie to belong the year y if its release date in the country falls in the calendar year y; $R_{i,c,y}$ includes the theatrical revenue collected by the said movie during its original release period. We have the following empirical specification.

$$\log(R_{i,c,y}) = \lambda_c + \delta_y + \beta * 1(c = USA) * netflixmovies_y + \epsilon_{i,c,y}. \tag{1}$$



(a) Number of Theatrical Releases by Country - 2007-19.



(b) Share of B.O. gross accruing to top 200 movies by country - 2007-19.

Figure 3

δ_y are year fixed effects and λ_c are the country fixed effects. The log-linear specification is motivated by the fact that there is substantial variation in the theatrical revenue between movies. Our parameter of interest β can be interpreted as the impact of Netflix, the percentage change in box office revenue with a unit increase in Netflix movies. The specification can be easily modified for another outcome variable of interest. We present the results of estimation in the following section.

4 Box Office Impact

A first question of interest is whether the availability of streaming movies was a substitute to watching movies at the theatre? We present a comparison of the annual total box office collection in the U.S. to the corresponding figures averaged across the European control countries (in 2005 US dollars). We do not see a noticeable drop in the overall box office revenues in the U.S., despite the population there having access to new movies via the Netflix platform. We estimate two models, one at the movie-country-year level and the other at the country-year level (see Table 2).

Annual Box Office Gross: U.S. and Europe

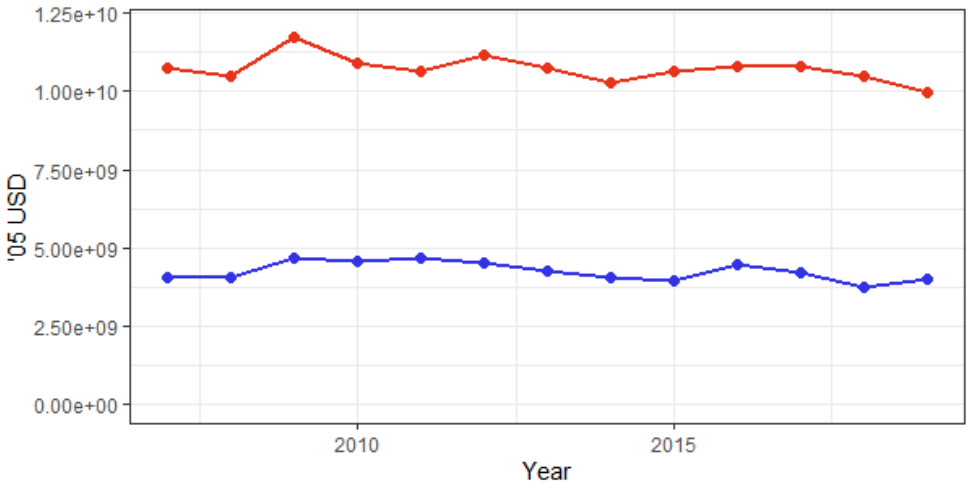


Figure 4: All figures are in 2005 US dollars. The annual grosses for Europe, is an aggregate across U.K., France, Germany, Italy, Spain and Russia.

Table 1: Estimated Impact of Streaming on Box Office

	$\log(R_{i,c,y})$	$\log(\sum_y R_{i,c,y})$
Netflix-movies*treated	0.00012	0.00094
	(0.00099)	(0.00088)
Year FE	True	True
Country FE	True	True
DF	7773	59
Adjusted R^2	0.593	0.986

Notes: Robust standard errors are reported.

*p<0.1; **p<0.05; ***p<0.01

The coefficient estimated is small and statistically insignificant at the conventional significance levels (robust standard errors are reported). On average, we do not find a statistically significant change in the box office receipts of a movie in the U.S. (compared to in Europe) with an increase in the availability of Netflix movies. Estimates presented in Table 1 point to no significant drop in overall U.S. box office with the advent of streaming movies. In other words, viewers did not (on aggregate) treat the Netflix movies as a substitute for watching movies at the theater. For the movie producers, the expanded scope of distributing new movies seem to have come up with no significant drop in the original channel. However, some caution is warranted before we conclude that streaming movies' aggregate impact on the U.S. box office has been negligible. Total demand for theatrical movie viewing can vary across years for the different countries. This makes a demand shift (in the U.S.) difficult to precisely test for. While we do not detect any overall dip in U.S. box office, in the following sub-section we turn to investigating if the availability of Netflix movies shifted audience demand across movies.

4.1 Heterogeneity in Impact

We divide the data into sub-groups based on rank and estimate the impact using the same specification. Dividing the data into sub-groups allows us to retain the easy interpretation of the coefficient estimates, as the average percentage change in receipts with increase in streaming availability within a sub-group.

Annual U.S. Box Office Gross: Top 10(g) vs 11-60(r)

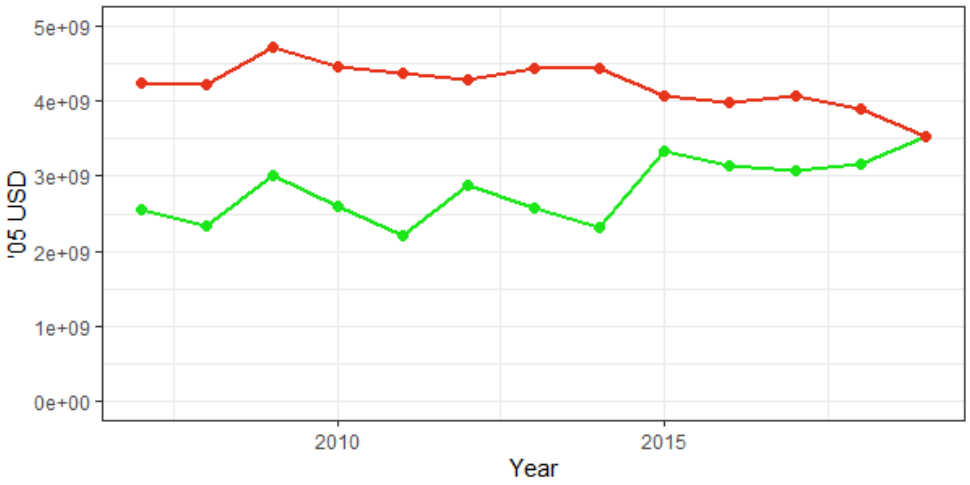


Figure 5: Aggregate box office figures of top 10 movies is plotted in green and aggregate box office figures of movies ranked 11-60 is plotted in red. All figures in 2005 US dollars.

Estimates from the analysis is presented in Table 2. Note that we detect a large and statistically significant increase in the box office receipts for the top 10 movies in the U.S. with increase in the number of streaming movies (see column i). An increase of 20 original movies (approx. average increase from 2015-2018) resulted in a 6.46% increase in the box office receipts of a top 10 U.S. movie (on average, compared to top 10 movies in the control countries). We also find (see column iii) a negative impact (significant at the 10% level) on U.S. movies ranked between 26-50, their box office revenue decreasing by approximately 1.9% (on average compared to movies in the control countries) with an increase of 20 original movies on Netflix. The estimates presented in Table 2 give us confidence that the availability

U.S. Box Office rank-size distribution: Pre (g) and Post(r) streaming

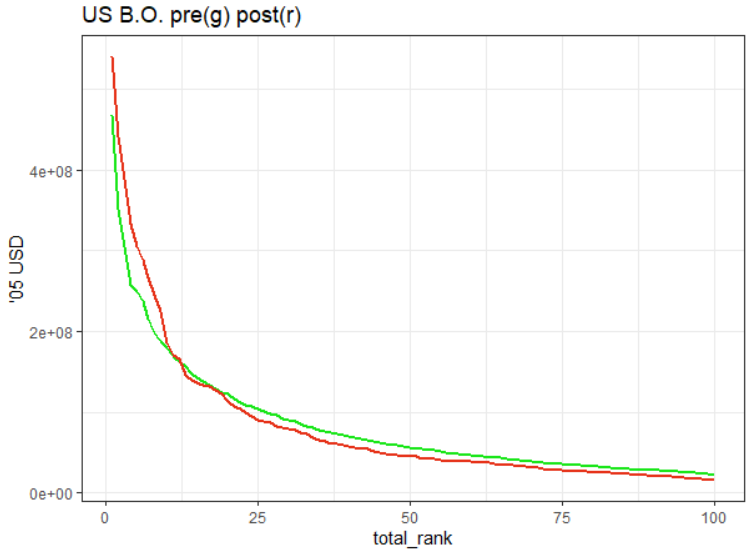


Figure 6: Box office figures of movies by rank, averaged over pre (2007-15) and post (2016-19) streaming periods are plotted in green and red respectively. All figures in 2005 US dollars.

of streaming movies have impacted viewers' theatrical choices and shifted demand towards blockbusters. For movies ranked from 11-50 we detect an average fall in the revenue of these movies but without the desired statistical precision. The approach still compares average box office revenues and suffer from the country-year variation in demand for theatrical movie consumption. However we can more reliably test for an increase in concentration of box-office revenues by turning our focus to the country-year variation in the share of box office revenues accruing to movies by their box-office rank.

5 Impact on concentration and sub-group analysis

Advancements in supply side technology brings an improved ability to cater to viewer tastes more flexibly. Consequent readjustments of the supply and consumer side decisions has been shown in different contexts to impact the concentration of product sales (see Brynjolfsson, Hu, and Simester, 2011). In the context of movie exhibition, the shift from film to digital production saw adjustments by theaters to offer more screenings (Rao and Hartmann, 2015)

Table 2: Estimated Impact of Streaming on Box Office (by Sub-group)

	1-10	11-25	26-50	51-100
Netflix-movies*treated	0.0032**	-0.00073	-0.00096*	0.00026
	(0.0013)	(0.00061)	(0.00054)	(0.00051)
Year FE	True	True	True	True
Country FE	True	True	True	True
DF	761	1151	1930	3874
Adjusted R^2	0.884	0.951	.940	.904

Notes: Robust standard errors are reported.
*p<0.1; **p<0.05; ***p<0.01

and increased variety (Yang, Anderson, and Gordon, forthcoming). While we did not detect viewers decreasing their theatrical visits with the availability of streaming movies, it is possible that they have reconfigured their choice of which movies to consume at the theater. In other words, would the introduction of streaming have shifted the viewers' theatrical choice? We know that movie watching at the theaters is a prominent social activity often undertaken in groups. Which movies to watch at the theater is a complex choice, but one which involves a trade-off between a personal taste-match and a movie's wider appeal. When streaming opens up the opportunity to consume new movies from homes, it is possible that viewers will recalibrate their theatrical choices in favor of movies with popular appeal. In other words, we have reason to expect that streaming could have impacted theatrical consumption by increasing the box office revenue to the more popular movies. As a first step, we evaluate whether there has been an increase in box office outcome of high ranked movies in the U.S. (relative to countries in Europe).

5.1 Share of B.O. Revenue

We continue with the rank sub-group from earlier, but now with a focus on concentration of revenues, test whether the share of revenues accrued by each (rank) group of movies has increased with the availability of streaming movies in the U.S. Shifting our focus to testing

for changes in share, brings with it advantages not available when testing for a change in total revenue. Box office revenue comparisons across countries over years, required adjusting for prices and exchange rates, whereas share of revenues accruing to different sub-groups can be compared without adjustments. While there can be variation in year-on-year demand for theatrical movie consumption, the year-on-year variation in share of total box office revenues accruing to a sub-group is smaller, making it easy to test for any changes in concentration.

We expect to detect an increase in the share of revenue accruing to higher ranked movies in the U.S., but not in Europe. In Fig.7 above we plot the share of total B.O. revenue accrued by each movie ranked 1 to 100 and average them before and after Netflix began streaming new movies, for U.S. and the same metric averaged across the countries in Europe. On inspection, one can indeed see a noticeable shift in the U.S. where the higher ranked movies are accruing a larger share of the revenues in the period since streaming. Whereas, in the graph on the right, we do not see a noticeable increase in the share of revenues accrued to top movies in Europe, consistent with our motivating reason. In the following subsection we discuss an empirical specification to more formally test the prediction.

Share of B.O. Revenues by Rank: USA and Europe

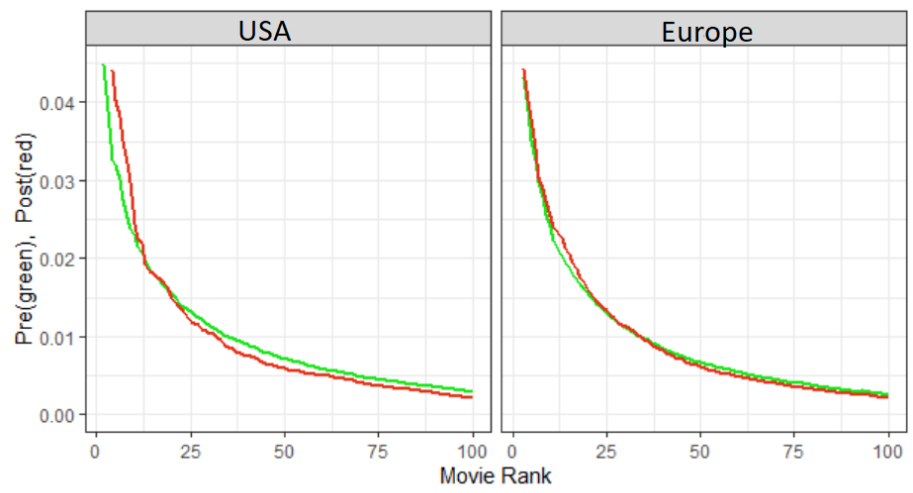


Figure 7: Share of a movie's revenue in total B.O. (rank 1-100) averaged over pre (2007-2015) and post (2016-2019) periods. For Europe, the constituent country average is presented.

We now modify our specification (in 1) slightly; the new outcome variable is the share of

box office revenue in a country-year. A shift in theatrical preferences towards blockbusters mean, we should expect to see an increase in the share of revenues accrued to high ranked movies in the U.S. and as we go to sub-groups comprising lower ranked movies, a natural decrease in the share of revenue accrued to them. Table 3 provides the estimates from the different sub-groups. We can see that for U.S. movies belonging to the top 10 ranks (column i) the share of box office revenues accrued by them has increased (relative to control), with an increase in Netflix originals. Again, for an increase in 20 Netflix original movies (the approx. avg. increase from 2015-2018) the share of revenues accrued by a top 10 U.S. movie increases by 0.002. Note that the share of revenue of a top 10 movie is between 0.05 and 0.01. In columns (ii) – (iv) we report estimates of the impact of increasing Netflix movies for the different subgroups. Movies outside top 10 in the U.S., has been impacted by a fall in the share of revenue accrued to them with the availability of streaming movies. The estimates are negative and statistically significant at conventional levels. The size of the estimate is small compared to the gain in share of the top movies expected as the top's gain comes from a relatively large set of movies.

Share of B.O. Revenues by Rank: USA and Europe

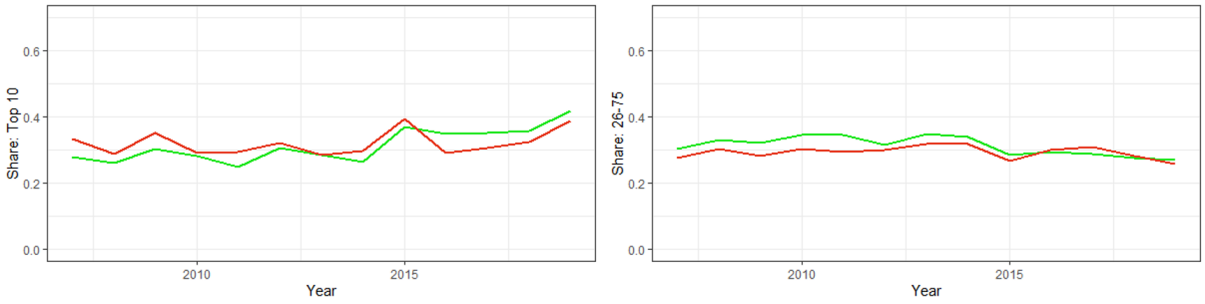


Figure 8: Share of a movie's revenue in total B.O. (rank 1-100) averaged over pre (2007-2015) and post (2016-2019) periods. For Europe, the constituent country average is presented.

We obtained statistically significant treatment estimates in the four sub-groups, and can be confident of the relative increase in concentration of box office revenue with streaming movies. A careful glance at fig. 7 will convey how for the sub-group comprising movies ranked 11-25, the negative treatment estimate is not caused by a fall in the revenue share of U.S.

Table 3: Share of Box-office revenue

	1-10	11-25	26-50	51-100
Netflix-movies*treated	0.00011**	-0.000027***	-0.000016***	-0.0000053***
	(0.000053)	(0.0000082)	(0.0000039)	(0.0000015)
Year FE	True	True	True	True
Country FE	True	True	True	True
DF	761	1151	1930	3874
Adjusted R^2	0.084	0.070	0.081	0.14

Notes: Robust standard errors are reported.
*p<0.1; **p<0.05; ***p<0.01

movies while revenue share of similar ranked movies in Europe do not fall. The treatment estimate is driven by an increase in share of revenues in Europe but not in the U.S. In other words the revenue share gain by the blockbusters is at the expense of movies ranked 25 and higher. The causal interpretation of our estimates rely on the parallel trends assumption, that in both U.S. and European countries the share of box office revenues accruing to the movies followed a common trend. In appendix 8 we present the results of the tests to rule out significant pre-trend.

6 Supply Side Explanations

To lend strength to the causal interpretation of our difference in differences analysis, we need to rule out supply side explanations of what could have caused an increase in the share of revenues accrued to blockbuster movies in the U.S. and coincided with the availability of original streaming movies from Netflix. We would like to rule out that starting around 2016, the U.S. movie producers increased (decreased) investments in some movies which went onto garner an increased (lesser) share of the box office, but such was not the case in Europe. We cannot however conclusively verify that such is not the case as budget information of all movies are unavailable. We obtain from IMDB pro the budgets of movies distributed by the

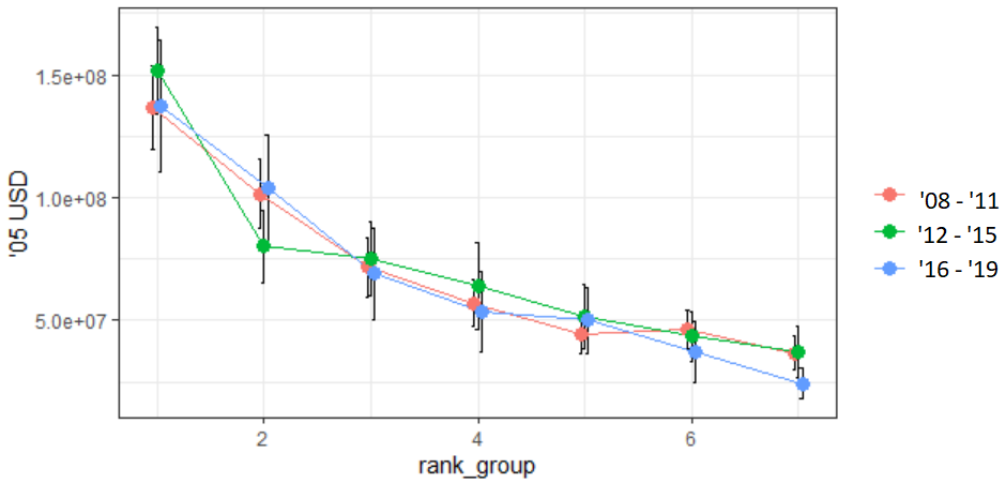
top six Hollywood studios. In Fig.9 below we look at the average budget of a studio movie ranked between 1-25 and those ranked above 25. We can rule out further investigations of any notable change in the production budgets of U.S. movies occurring around 2016.

7 Genre Overlap

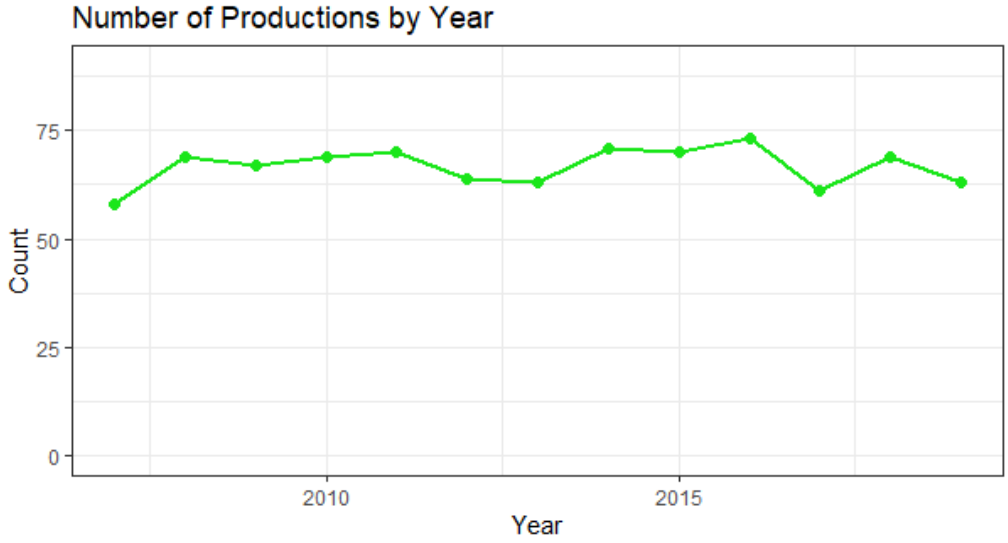
Movies with the widest appeal and the potential to realise the highest box office outcomes are more likely to include cinematic elements (visual and sound effects) that are best enjoyed at the scale and quality of a theater, contributing to their popular appeal. To lend support to our finding that the onset of streaming movies has led viewers to change their theatrical choices in favor of these movies, we explore whether streaming movies are a closer match in their content and nature, not to the blockbusters that form the top of the box office pecking order, but to the movies that follow. Here we present some empirical support towards the same. The nature and type of a movie is best captured by its genre. In line with our reasoning, we would expect the genre distribution of Netflix movies to be more distant from the genre distribution of blockbusters and less distant from the genre distribution of movies that are ranked lower at the box office.

We obtain genre tags of the movies in our analysis from IMDB. As there are eighteen different tags against the movies in our data and each movie has anywhere between two to five tags, we cluster movies based on their genre tags as a dimension reduction step before comparing the genre distribution. In fig.10 below we can verify that the top ten movies in the United States belong to genre-clusters 6 and 7 whereas Netflix movies predominantly belong to genre-clusters 1 and 2. For movies ranked 25-50 and 51-100, whose share of box office revenue we have found to decrease coinciding with the availability of Netflix movies, the genre distribution is much closer to that of Netflix movies. The patterns are consistent with our reasoning that Netflix movies are a closer substitute to movies that have relatively lower earnings potential at the box office. We also compute relative entropy (KL distance;

U.S. Studios: Budgets and Productions



(a) Average production budgets by rank-groups across three periods. Group 1 comprises 10 highest grossing studio movies, group 2 the next 10 and so on.



(b) Number of movies (released in U.S.) by the major studios.

Figure 9

see fig.10) of the respective genre distributions from the Netflix movies, which decreases as we move towards distributions of movies of lower ranks.

Genre Comparison: U.S. Theater Releases (by rank) and Netflix

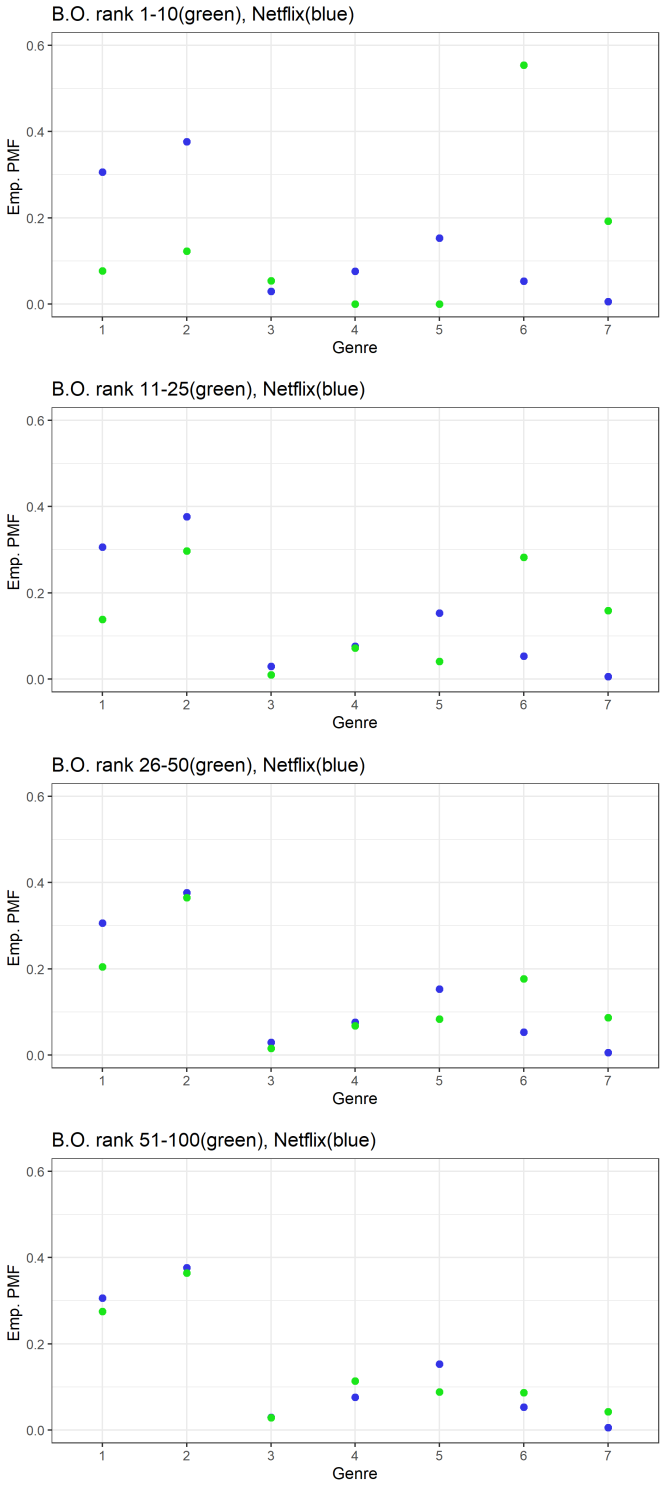


Figure 10: Genre Compositions of top 10, ranks 11-25, 26-50 & 51-100 of US movie releases are compared to genre composition of Netflix movies. The relative entropy of the respective distributions from the Netflix distribution $D_{KL}(.||N)$ are 0.74, 0.51, 0.25 and 0.12 respectively.

8 Discussion

This paper presents empirical evidence that the emergence of streaming platforms as an alternative mechanism of distributing new movies has impacted viewers' theatrical choices. While we did not detect any fall in total box office revenues, we find a notable fall in the share of revenues accrued to non-blockbuster movies; movies that we find are also more comparable in their genre composition to streaming movies. While there is considerable interest and speculation on the impact of streaming and in-home movie consumption on the box-office, there is very little causal evidence on the subject. We provide a causal estimate of the magnitude and importantly, nature of this impact. Armed with this clarity, we can confidently look forward to an array of supply side decisions being affected as streaming consolidates itself as a competing mode of distributing new movies. An exclusive theatrical release window has been the distribution strategy for a large set of movies with differences in their genre and production costs. We are poised to see changes in both the exclusivity and length of this theatrical window, along with changes in movie production decisions; in short an area of rich possibilities of future research.

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Appendix A. Additional Background Information

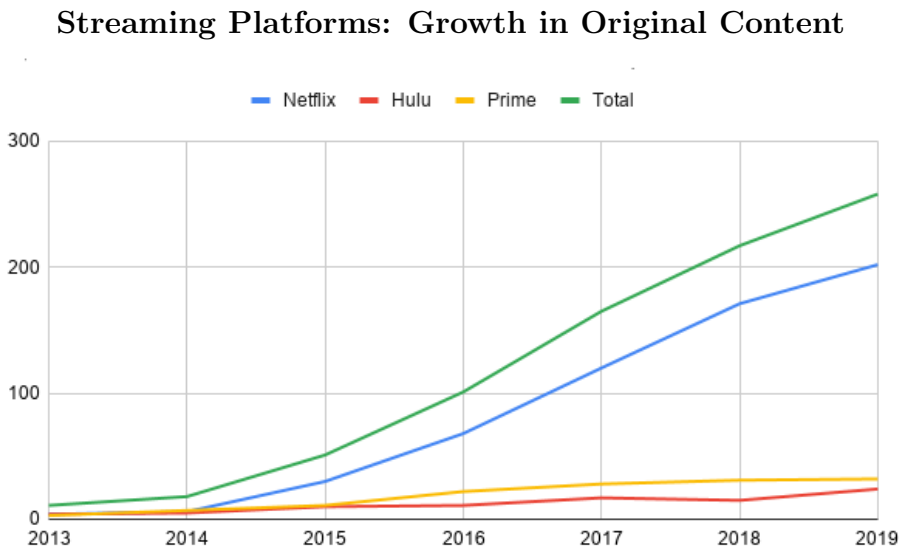


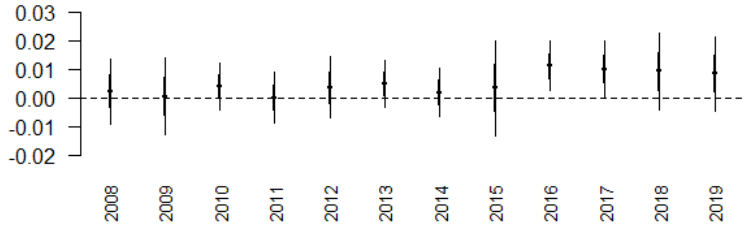
Figure 11: Number of English language original programs released by the top three streaming platforms until 2019.

Appendix B. Parallel Trend Assumption

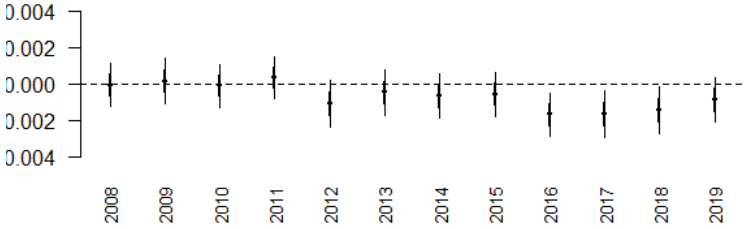
We verify that our difference in differences regressions presented in Table 3 satisfy the parallel trends assumption. Below we plot the coefficient estimates of β_y from the regression below, for the different movie sub-groups.

$$\frac{R_{i,c,y}}{total_{c,y}} = \lambda_c + \delta_y + \sum_y \beta * I(c = USA) * I(Y = y) + \epsilon_{i,c,y}. \tag{2}$$

Top 10 B.O. share US-Europe difference compared to 2007



(26-50) B.O.share: US-Europe difference compared to 2007



(51-100) B.O.share US-Europe difference compared to 2007