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Competition and Retailer Product Choice: Evidence from the Movie Theater Market

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Abstract

In this paper, we empirically study the effect of entry on product repositioning, differentiation, and variety. Using a rich panel data set on theaters' weekly screening schedules, we provide evidence that the degree of differentiation between theaters in a local market rises after entry of new theaters. Moreover, incumbent theaters tend to reallocate seats from a handful of the most popular movies to less popular ones, suggesting that theaters will differentiate themselves by lowering the quality of its movie portfolio after entry of rivals. Although the overall impact of entry on an incumbent theater's movie variety is not significant, movie differentiation by theaters leads to an increase in movie variety in the local market.

Keywords: product differentiation, product variety, product repositioning, multiproduct retailer, movie theater industry

JEL Classification Numbers: L13, L22, L82

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1 Introduction

Oligopolistic firms make strategic decisions on product type. Location models of product differentiation (Hotelling, 1929; Lancaster, 1979; Salop, 1979) introduce two opposing forces driving their decision. On the one hand, a firm is tempted to choose the product location in the product space where demand is strong. On the other hand, the fear of intensified competition induces it to use differentiation and choose a less attractive location. Competition also affects a firm's product variety decision. Although the decrease in sales after entry of competitors would motivate an incumbent firm to reduce its product range, it may have an even stronger incentive to offer wider product variety in order to attract more consumers (Anderson and de Palma, 1992; Cachon et al., 2008; Kaiser and Reisinger, 2017).

This paper attempts to empirically examine the effect of competition on a multiproduct retailer's decisions on product positioning, differentiation, and variety as well as its implications for product variety in the local market. Previous work finds that single-product retailers have strong incentives to differentiate the product type they offer in local retail markets (Mazzeo, 2002; Seim, 2006; Cohen and Mazzeo, 2007; Schaumans and Verboven, 2008). By contrast, a multiproduct retailer's choice of products has been relatively less explored despite its prevalence. In addition, little empirical work has examined the effect of competition on a multiproduct retailer's product variety choice. This paper aims to fill this gap in the particular context of the movie theater industry. The industry possesses several advantages for our purpose. First, new movies are released each week, incurring strategic movie choice and seat allocation decisions for theaters. Second, since movies are standardized, theaters differentiate themselves through the number of movies playing (variety) and the number of seats allocated to each movie (inventory depth) as well as their spatial locations. Both variety and depth of inventory in each theater are easily observable.

Using a rich panel data set containing weekly screening schedules of theaters in Korea and their entry/exit history, we first study how entry affects movie variety in an incumbent theater and in a local market as well as differentiation between theaters. Considering the weekly number of movies playing in a theater as a proxy for movie variety in the theater, we find that the overall impact of entry on an incumbent theater's movie variety is not significant. However, market-wide movie variety increases after entry of theaters. Specifically, the number of movies playing in a local market increases by 1.8 when a new theater opens in the market. Then, measuring the distance between a pair of theaters by cosine similarity, we provide evidence that the degree of differentiation between theaters in a local market rises after entry of new theaters. These findings imply that differentiation by theaters would not only soften competition, but also lead to an increase in market-wide movie variety which

may promote the positive agglomeration effect without imposing the burden of increasing movie variety on each theater.

Next, using the weekly audience size ranking of a movie as a proxy for its (relative) popularity, we examine the effect of entry on an incumbent theater's seat allocation across movies of different popularity. We find that entry induces an incumbent theater to reallocate seats from a handful of the most popular movies to the remaining less popular ones. Given the observation that theaters' screening schedules overlap less in less popular movies, this result suggests that theaters would differentiate themselves by lowering the quality of their movie portfolios after entry of rivals.

Using only observations from a window of six weeks before and after entry (or exit) to assess its short-run effects yields estimates that are consistent with previous findings. The results are also robust to changes in the measure of market structure and in the local market definition, and after addressing the potential endogeneity concern, we obtain similar estimates.

This paper is closely related to the empirical literature on variety competition among multiproduct retailers.[1] Watson (2009) finds a non-monotonic relationship between product range and competition in the retail eyeglasses markets. Ren et al. (2011) show that while competition from distant rivals induces product variety in an electronics store to increase, collocated stores have fewer overlapped products than non-collocated ones do in order to differentiate themselves and enjoy agglomeration gains. Building on the cross-sectional variety literature, we further examine the within-theater and within-market effects of entry.

There are several empirical articles that examine product or quality repositioning of incumbent firms after entry of rival firms. George and Waldfogel (2006) show that increased availability of *The New York Times* induces local newspapers to change their targeting, offering more local coverage. Prince and Simon (2014) provide evidence that incumbent airlines worsened their on-time performances in response to entry of Southwest Airlines. Bauner and Wang (2017) find that after wholesale club entry, incumbent retailers tend to increase assortments for less storable products, but reduce assortments for more storable products. In line with these studies, this paper looks closely at how incumbents are reacting to entry in the movie theater industry. Given the price rigidity in the industry, analyzing non-price effects of entry would improve our understanding of how theaters compete. Therefore,

[1]For retailers, product variety and availability are two sides of the same coin in that there is a trade-off between depth (large inventory of each product) and breadth (product variety) of inventory. Olivares and Cachon (2009) find evidence that the competition of rivals induces automobile dealers to improve their service level, measured by the amount of buffer stock. Similarly, Matsa (2011) shows that competition reduces the likelihood of inventory shortfalls (stockouts) in the supermarket industry. Literature on a retailer's optimal product assortment that incorporates both variety and inventory decisions include Ryzin and Mahajan (1999), Smith and Agrawal (2000), Carlton and Dana (2008), and Honhon et al. (2010).

by studying the effect of entry on product repositioning, differentiation, and variety, this paper aims to provide a holistic view of the phenomenon.

Recent literature on the competition effects in the movie theater industry also bears on this paper. Davis (2006a,b) shows that demand is localized due to a significant traveling cost, which in turn causes the effect of entry on an incumbent's revenue to be limited to a 15 mile radius in U.S. movie theater markets. Chisholm et al. (2010) show that programming similarity between a pair of movie theaters decreases as the distance between the two theaters decreases. Orhun et al. (2015) examine the effect of competition on movie quality decision and show that the movie quality in an incumbent theater decreases after entry. Moreover, the decrease is smaller when the entrant belongs to a rival chain, implying a positive competitive incentive. This paper contributes to the literature by examining how an incumbent theater adjust its seats across movies facing different types of new competitors.

The remainder of the paper proceeds as follows. In the next section, we provide background information on the movie theater industry in Korea and describe the data. Sections 3 and 4 are the main focus of the paper where we evaluate the effect of entry on variety, differentiation, and seat allocation. We perform robustness checks in Section 5 and conclude in Section 6.

2 Background and data

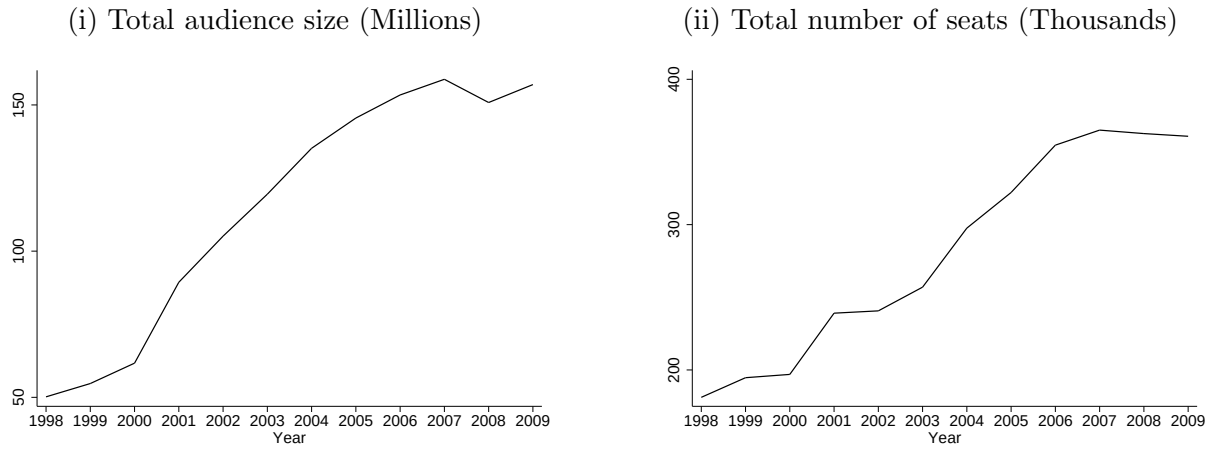
Industry background

The movie theater industry in Korea has been drastically expanding since the late 1990s. According to the left panel of Figure 1, the aggregate audience size was approximately 50 million in 1998. However, it tripled and reached 150 million by the mid 2000s. The expansion of movie demand coincides with the increase in the total number of seats in theaters, as the right panel of Figure 1 shows. Thanks to the rapid growth in the past two decades, the Korean movie theater industry became one of the largest in the world: it had the sixth largest market in terms of box office revenue in 2015.[2]

There were five national theater chains, CGV, Lotte, Megabox, Cinus, and Primus, in Korea during the 2000s. Together, they owned 174 theaters with 1,336 screens out of 348 theaters with 2,058 screens in total in 2007. Also, three chains, CGV, Lotte, and Megabox, were vertically integrated with distributors, as integration between distribution and exhibition is

[2]The Korean movie theater industry is also characterized by a high level of per capita attendance. Koreans went to the movies 4.22 times on average in 2015. Source: MPAA Theatrical Market Statistics 2015, Korean Film Council Annual Report 2015.

Figure 1: Rapid expansion of the movie theater industry in Korea



Source: Korean Film Council (KOFIC) Annual Reports.

legal in Korea.[3]

One important characteristic of the movie theater industry is that the ticket price is uniform across movies.[4] For example, in 2009 it was mostly 5.5 U.S. dollars in Seoul on weekdays. Orbach and Einav (2007) list perceived fairness, demand uncertainty, and monitoring costs as possible explanations for the practice of uniform pricing. The admission price is also rigid in that it is not responsive to changes in the local market structures. Davis (2005) finds no evidence that movie ticket prices rise in response to an increase in geographic concentration in the U.S. movie theater industry, while Sorensen (2007) points out the rigidity of product price in the media industry, especially in the movie theater industry. Given the rigidity of the admission price, in this paper we focus on analyzing non-price effects of entry to better comprehend how theaters compete.

Whereas distributors and exhibitors use movie and theater specific revenue sharing contracts in countries such as the US and Spain (Gil, 2009; Orhun et al., 2015), it is constant across movies and theaters in Korea: half of the after-tax box office revenue goes to the theater, while the distributor, the producer, and investors share the rest.[5] Fixed admission price and revenue sharing imply that the price-cost margin is constant across movies in the Korean movie theater industry.

[3]Primus was owned by CGV. Also, an investment group led by Macquarie acquired Megabox theaters from Orion in 2007. According to the contract, however, Orion was guaranteed to run Megabox theaters for the next 10 years.

[4]The price can differ across times and days, however. For instance, tickets of early morning shows are cheaper than those of evening shows.

[5]Exceptionally, theaters in Seoul take only 40 percent of the box office revenue from movies distributed by foreign distributors after deducting taxes.

Data

In this paper, we analyze movie theaters located in the seven largest metropolitan cities in Korea (Seoul, Busan, Incheon, Daegu, Daejeon, Gwangju, and Ulsan) as well as Gyeonggi province, the most populous province. Together with the two metropolitan cities, Seoul and Incheon, Gyeonggi province constitutes the Seoul Metropolitan Area. The Korean Film Council updates the list of existing theaters on its website at the end of each year. This yearly list also contains theater information such as location, the number of screens, the number of seats in each screen, opening and closing dates as well as the name of the chain. By combining the yearly lists, we construct panel data of theaters from 2005 to 2009.[6] We exclude art theaters from the analysis, as they specialize in showing small art-house films, and hence are not directly competing with commercial movie theaters.

For the empirical analysis, it is necessary to properly define local movie theater markets. We set a circle of one mile radius around a theater as its local market and consider other theaters located in this area as its competitors. The one mile threshold value is based on previous literature (Kim et al., 2015) showing that in Korea the negative effect of competition on a theater's revenue is not significant if the competitor is located farther than one mile away. A one mile threshold is also used to separate retailers that are directly competing from distant ones in many other industries (e.g. gas stations (Hastings, 2004), eye glasses stores (Watson, 2009), and electronics stores (Ren et al., 2011)).[7]

In addition, when we assess the effects of competition on movie differentiation and market-wide movie variety, we consider administrative districts as local markets. The seven metropolitan cities are subdivided into "Gu"s, which we call districts. For example, there are 25 districts in Seoul whose average size is 24.2 km^2. Gyeonggi province has several administrative subdivisions, including cities, that are subdivided in turn into two or three districts. For smaller cities and towns in the province without further subdivision into districts, we consider the city itself as a district. There are 87 districts in the sample data.

Next, using a web crawler we download the screening schedule of each theater from the Korea Box Office Information System (KOBIS).[8] The data show which movie was played in each screen of a theater at each time slot during a day. By merging the screening schedule data with the information on the number of seats in each screen, we calculate the weekly number of seats allocated to each movie in a theater.

The movie audience data available at KOBIS provide the nationwide weekly audience size

[6] As Figure 1 shows, the movie theater industry in Korea started to expand in the late 1990s. Unfortunately, screening schedule information for each theater is available only from 2005.

[7] As a robustness check, we also consider broader local market definitions. See Table A-4 and Figure A-4.

[8] The Korean Film Council: http://www.kofic.or.kr/, KOBIS: http://www.kobis.or.kr/.

of a movie.[9] We compute the weekly ranking of a movie based on its audience size. One useful property of the data compared to others used in previous work (Einav, 2007; Moul, 2008; Gil, 2009) is that it provides weekday (Monday through Thursday) and weekend (Friday through Sunday) audience sizes separately. Later, we exploit this property to address a potential endogeneity problem in our approach.

Finally, we combine the three data sets on theaters, their screening schedules, and movie audience sizes, and create the following variables for each theater and week: (i) the number of competitors (both in total and separated by their types based on ownership), (ii) the number of movies playing, and (iii) the seat share of a movie, that is, the number of seats allocated to the movie divided by the total seat counts for all movies. For instance, if a theater does not play a movie at all, then the seat share of the movie in the theater is zero. Also, for each district and week we calculate the number of theaters and the number of movies playing.

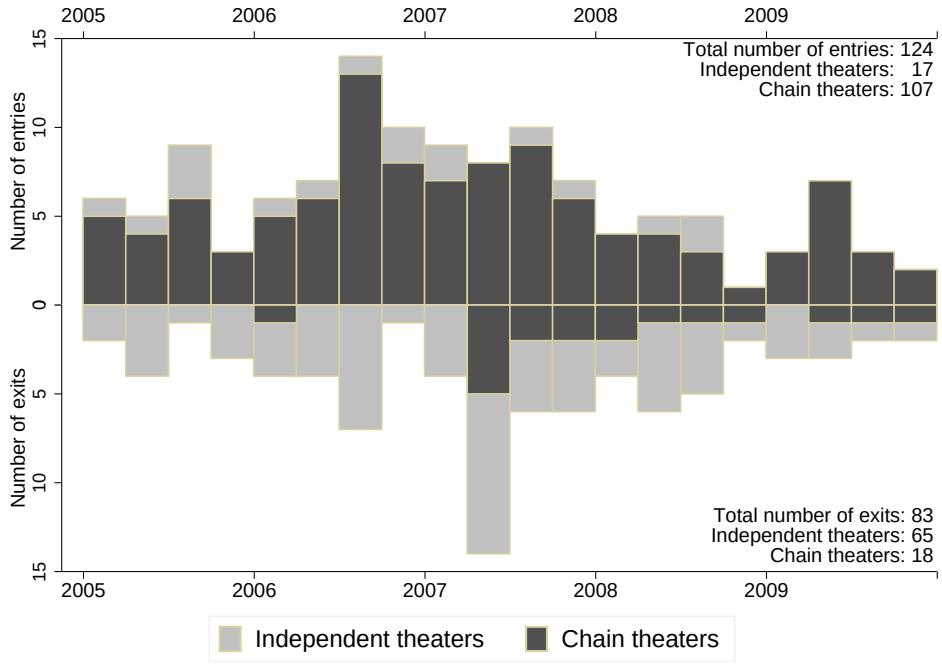
Table 1 provides summary information for the key variables. There are 248 theaters located in 86 districts. Among them, 155 theaters belong to chains and the remaining 93 theaters are owned independently. There are 2 theaters in a district on average. While each plays 9.5 movies on average, together they play 13 movies in a week. An average independent theater is equipped with 7 screens and faces 2.2 competitors. On average, a chain theater is bigger than an independent one, and has fewer competitors. Moreover, most of its competitors are owned either independently or by rival chains. This shows that theater chains open new theaters close to rival chains' theaters or independent theaters rather than close to their own incumbents (Davis, 2006b). The distribution of the seat share is right-skewed. While a theater allocates 840 seats or 1.5 percent of its seating capacity to a movie in a week on average, there are cases in which a theater allocates all its seats to a movie.

In the data, there are 124 theaters that opened and 83 theaters that closed during the sample period. The histograms in Figure 2 present how often entry and exit take place in each quarter. Note that most of the new theaters (107 out of 124) are chain theaters, whereas the majority of exiting theaters (65 out of 83) are independently owned. This observation is consistent with the industry view that new chain theaters have been replacing older independent theaters in recent decades (Davis, 2006b). Also, there is no observable seasonality in entry and exit patterns, so both occur quite evenly over the sample period.

According to Table 2, among 248 theaters in the sample data, 83 (79) theaters experienced entry (exit, respectively) of at least one competitor within its one mile radius, while 113 theaters observed either entry or exit at least once. One or more theaters opened (closed)

[9]The audience sizes of non-regular showings such as re-released movies, performances, and concerts are not reported.

Figure 2: Entry and exit of theaters



Notes: The histograms in the figure show the numbers of entries and exits of theaters in each quarter.

in 41 (28, respectively) out of 86 districts, while entry or exit occurred at least once in 51 districts. For the analysis of movie differentiation, we use 58 districts that have least two theaters.[10] Among them, there are 27 districts that experienced either entry or exit at least once. Consequently, change in the local market structure is quite common in the sample, so we can explore its impact on an incumbent theater's decisions on movie variety and differentiation. An important identifying assumption underlying our analysis is that entry and exit have symmetric effects.[11]

3 Analysis of variety and differentiation

In this section, we first show how entry affects movie variety in an incumbent theater and in a local market. Following previous literature on product variety (Watson, 2009; Ren et al., 2011; Orhun et al., 2015; Argentesi et al., 2016), we consider the number of movies as our measure of movie variety. Then, we examine the effect of entry on movie differentiation.

[10]For instance, if a new theater entered a monopoly market, then only observations after the entry are used in the analysis of movie differentiation.

[11]In the robustness section, we consider an alternative specification that relaxes the assumption of symmetric effects.

Entry and market-level movie variety

We first study how entry of theaters into a local market affects movie variety in the market using the model:

$$Movies_{mt} = \alpha_0 + \alpha_1 Theaters_{mt} + \psi_m + \tau_{ct} + u_{mt}, \tag{1}$$

where the dependent variable $Movies_{mt}$ is the number of movies playing in local market (district) m at time t. $Theaters_{mt}$ is the number of theaters in the market and its coefficient α_1 measures the effect of entry on market-wide movie variety. Market and time specific error term u_{mt} contains unobservable factors affecting movie variety in the market.[12]

Since entry is not a primitive but rather a choice variable, there is a potential endogeneity concern. We attempt to address this issue by adding market and city-time fixed effects in the model. Market fixed effects ψ_m control for time-invariant, market specific characteristics such as location. City-time fixed effects τ_{ct} allow market-level movie variety to vary across cities over time, hence controlling for factors such as city-specific seasonality in movie demand. Hence, there would be no endogeneity problem in our approach to the extent that entry is correlated only with factors that can be controlled for with these fixed effects. If, however, there are time-varying market specific unobservables that affect theaters' entry and movie variety decisions simultaneously, our estimates would be biased. For example, one may think that a short-term demand shock that occurs only in a certain local market at a certain time will lead to both entry of theaters and change in movie variety in the market at that time. However, we find this unlikely since the entry decision would be planned far before the occurrence of such a short-term demand shift (Orhun et al., 2015).[13] In Section 6, we consider an alternative approach to dealing with the endogeneity concern.

Estimation results of model (1) reported in the first two columns of Table 3 indicate that market-wide movie variety increases after entry of theaters. Specifically, the number of movies playing in a local market increases by 1.8 after a new theater opens in the market. When we separate the number of independent theaters, $Theaters^{ind}_{mt}$, from that of chain theaters, $Theaters^{chain}_{mt}$, the results in the next two columns show that the number of movies playing in a local market increases more after a chain theater's entry (approximately by 2) than after an independent theater's entry (by 1.4). This may be due to the fact that a chain theater usually has more screens than an independent one.[14]

[12] We estimate the model with robust standard errors clustered by market.

[13] Producers may have strategic incentives to increase product variety in order to prevent entry of potential rivals (Hong and Lee, 2015). According to industry sources, however, it is unlikely that a theater increases the number of movies for that purpose.

[14] The difference is significant at the 5 percent level. In the robustness section, instead of the number of

Entry and theater-level movie variety

Next, we examine the effect of entry on movie variety in an incumbent theater using a model in which the number of movies playing in theater j at time t is given by:

$$Movies_{jt} = \beta_0 + \beta_1 Competitors_{jt} + \mathbf{x}_{jt}\gamma + \psi_j + \tau_{ct} + u_{jt}, \tag{2}$$

where $Competitors_{jt}$ is the number of competitors in the local market of theater j (a circle of one mile radius around it) and its coefficient β_1 measures the overall impact of entry on an incumbent theater's movie variety. The vector $\mathbf{x}_{jt}$ includes an indicator that is equal to 1 for the opening week of the theater and zero otherwise, and a similarly defined closing week indicator: theaters may play fewer movies when they open or close compared to their normal business days. Theater and city-time fixed effects, ψ_j and τ_{ct}, are also included in the model, and hence, similar to specification (1), the effect of entry is identified mostly by the within-theater change in movie variety when new theaters are added to the local market. u_{jt} is a theater and time specific error.[15]

An incumbent chain theater may react in different ways to entry of theaters depending on their ownership. Therefore, we categorize entrants into the following groups: (i) theaters owned independently, (ii) theaters owned by rival chains, and (iii) theaters owned by the same chain. Then, using observations of chain theaters only, we also estimate the model:

$$\begin{aligned} Movies_{jt} = \beta_0' + \beta_1' Competitors_{jt}^{ind} + \beta_2' Competitors_{jt}^{rival} + \beta_3' Competitors_{jt}^{own} \\ + \mathbf{x}_{jt}\gamma + \psi_j + \tau_t + u_{jt}. \end{aligned} \tag{3}$$

In the specification, $Competitors_{jt}^{ind}$ ($Competitors_{jt}^{rival}$ and $Competitors_{jt}^{own}$) is the number of competitors owned independently (owned by rival chains and by the same chain, respectively) and the parameter β_1' (β_2' and β_3') captures the effect of such a competitor's entry on the number of movies playing in chain theater j. We estimate model (3), using monopoly theaters that experience entry of a rival and duopoly markets that become monopolies after exit of a theater during the sample period. This is because when there are two or more incumbents, each theater's movie variety choice will not only be affected by entry of a new theater, but also by the choice of its existing rivals. For instance, a chain theater may react to the entry of a rival chain's theater in different manners depending on the ownership of other incumbents. To help with the identification of coefficients, we also include markets that stay as monopolies during the sample period. Similarly, we analyze the effect of entry of

theaters we use their screen counts and hence directly control for the size of an entrant.

[15] We estimate the model with robust standard errors clustered by theater.

theaters (i) owned independently and (ii) owned by chains on movie variety in an incumbent independent theater.

Estimates in the first two columns of Table 4 show that the overall impact of entry on an incumbent theater's movie variety is not statistically significant and much smaller in magnitude than its impact on market-wide movie variety. According to the estimation results in the next four columns, movie variety in an incumbent theater rises after entry of a new theater only in the case where the two theaters are owned by the same chain. It may be the result of their collaboration to attract more consumers by offering more movies together. However, as we saw before, it is rare that a chain theater enters to a local market where there is already another theater owned by the same chain, and as a result the overall effect of entry on theater-level movie variety is negligible.

In sum, the analysis of movie variety shows that entry has a positive effect on the number of movies in a local market, whereas there is no strong evidence that the number of movies in an incumbent theater is affected by entry of theaters.[16] Together, these findings imply that a theater tends to offer a movie lineup different from those of competitors.

Entry and movie differentiation

Now, using markets with two theaters or more, we examine the effect of entry on movie differentiation. Similar to previous literature (Sweeting, 2010; Hwang et al., 2010), we use cosine similarity to measure the distance between a pair of theaters. Specifically, we assume that each theater (in a given week) is located in a movie space, where each movie is a separate dimension, by a vector, A, that lists the seat shares of movies in the theater.[17] Then, the similarity between theater i and j at time t is

$$Similarity_{ijt} \equiv \frac{A_{it}' A_{jt}}{||A_{it}|| \cdot ||A_{jt}||},$$

that lies between 0 and 1. Note that the higher the value of the measure, the larger the similarity between the two theaters.

We calculate the similarity of each pair of theaters in a given market (district) and time, and examine how it changes after entry of theaters:

[16] This may be partially caused by the use of different local market definitions in each analysis: a district in market-wide move variety analysis and a circle of one mile radius around a theater in the theater-level movie variety analysis. When we consider districts as local markets in the latter analysis, the estimated effects become even smaller in magnitude because a district is usually larger than a circle of one mile and thus includes remote competitors. See the first two columns of Table A-4.

[17] For instance, suppose that there are three movies, X, Y, and Z, available for screening and a theater with 300 seats allocates 200 and 100 seats to the first two movies, while not playing the last one. Then, its vector would be $(\frac{2}{3}, \frac{1}{3}, 0)$.

$$Similarity_{ijt} = \nu_0 + \nu_1 Theaters_{mt} + \psi_m + \tau_{ct} + u_{mt}. \quad (4)$$

Estimates in the first two columns of Table 5 show that the degree of differentiation between theaters in a local market rises after entry of new theaters, while estimates in the next two columns indicate that the drop in the similarity between a pair of theaters is greater after entry of an independent theater than after entry of a chain theater.[18] One possible explanation would be that entering independent theaters differentiate themselves from incumbent theaters more than entering chain theaters do. These results, together with the previous findings from the movie variety analysis, suggest that movie differentiation by theaters would not only soften competition, but also lead to an increase in market-wide movie variety, which may promote the positive agglomeration effect without imposing the burden of increasing movie variety on each theater.

4 Analysis of seat allocation

Although we found evidence of movie differentiation from the analyses in the previous section, it is unclear exactly how incumbents reacts to entry. In particular, which movies does an incumbent theater play more (or less) after entry of a competitor? Therefore, in this section, we attempt to compare the seat shares of movies of a given weekly ranking in an incumbent theater before and after entry of a competitor and examine how changes in the seat share vary across different weekly rankings. This may not only provide evidence of movie repositioning by an incumbent theater, but also shed light on how it differentiates itself further after entry of rivals. In addition, leveraging the detailed screening schedule data, we further scrutinize the differential effects of entry depending on the ownership of incumbents and entrants.

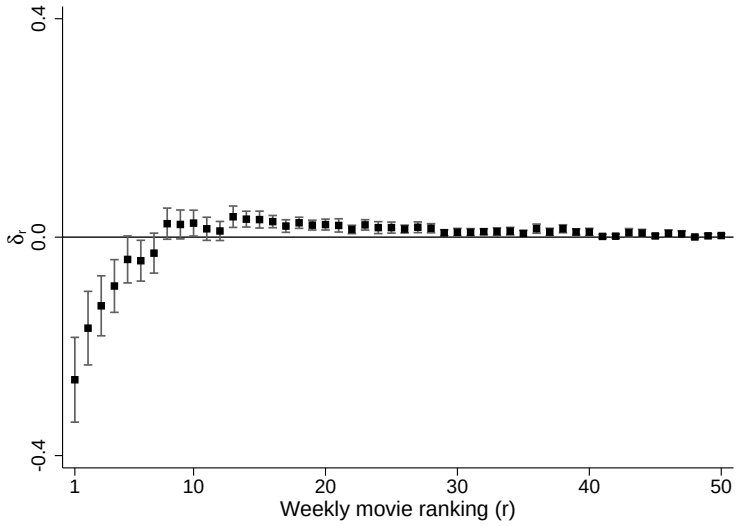
We start the analysis of seat allocation with the following specification:

$$Seat\ Share_{ijt} = \left(\delta_0 + \sum_{r=1}^{50} \delta_r I_{it}^r \right) Competitors_{jt} + \mathbf{x}_{ijt}\lambda + \psi_j + \tau_t + u_{ijt}, \quad (5)$$

where the dependent variable $Seat\ Share_{ijt}$ is the seat share (%) of movie i in theater j at time t. As before, $Competitors_{jt}$ is the number of competitors in the local market of theater j (a circle of one mile radius around it), and I_{it}^r is an indicator of whether the weekly ranking of the movie is rth. Note that the ranking of a movie is based on its audience size, and hence we use it as a proxy for its (relative) popularity. δ_r measures the effect of entry on the seat share of the rth ranked movie in an incumbent theater over and above its effect on the seat

[18] We estimate the model with robust standard errors clustered by market.

Figure 3: The effect of entry on an incumbent theater's seat allocation



Notes: The figure shows the effect of entry on an incumbent theater's seat allocation across movies of different weekly rankings along with 95 percent confidence bands.

share of a movie whose ranking is below 50th, captured by δ_0.

The vector $\mathbf{x}_{ijt}$ includes a constant, the movie ranking indicators I_{it}^r for r ranging from 1 to 50, and the demand share of movie i at time t, that is, its weekly audience size divided by the total audience size in the week.[19] The vector also includes another indicator that is equal to 1 if the movie is released by a vertically integrated chain and playing in a theater of the chain. Previous work on the vertical integration between distribution and exhibition in the movie theater industry (Gil, 2009; Fu, 2009) shows that integrated theaters assign more screens to their own movies and play them longer than other movies. Theater fixed effects ψ_j control for the theater characteristics that may affect the seat share of a movie. For example, there are theaters that designate one or two screens to low-budget movies whose rankings are usually low. Time fixed effects τ_t control for factors such as the number of movies available for screening, while the error term u_{ijt} is movie, theater, and time specific.[20]

Identification of the parameters in model (5) hinges on the assumption that once the demand share is controlled for along with other variables, the expected seat shares of movies of a given weekly ranking in a theater would be the same over time without entry or exit of a competitor. This assumption is reasonable because a theater's seat allocation decision is mainly based on the (relative) demand of each movie.

Figure 3 plots estimates of δ_r for r from 1 to 50 along with their 95 percent confidence

[19]Weekly audience size of a movie may be affected by theaters' seat allocations. We address this potential endogeneity issue in the next section.

[20]We estimate the model with robust standard errors clustered by movie.

bands.[21] Clearly, entry induces an incumbent theater to reduce the number of seats for a handful of the most popular movies, but instead increase the number of seats for the remaining less popular ones. After entry of a competitor, for instance, the seat share of the highest ranked movie decreases by 0.26 percent point in an incumbent theater, whereas the seat share of the 10th ranked movie increases by 0.03 percent point. Given the observation in Figure A-1 that theaters' screening schedules overlap less in movies of lower rankings, this result implies that theaters would differentiate themselves by lowering the quality of their movie portfolios after entry of rivals.

Next, we separately estimate the effects of entry of theaters that are (i) owned independently, (ii) owned by a rival chain, and (iii) owned by the same chain on the screening schedule of an incumbent chain theater in the following specification:

$$\begin{aligned} Seat\ Share_{ijt} = & \left(\kappa_0^{ind} + \sum_{r=1}^{50} \kappa_r^{ind} I_{it}^r \right) Competitors_{jt}^{ind} \\ & + \left(\kappa_0^{rival} + \sum_{r=1}^{50} \kappa_r^{rival} I_{it}^r \right) Competitors_{jt}^{rival} \\ & + \left(\kappa_0^{own} + \sum_{r=1}^{50} \kappa_r^{own} I_{it}^r \right) Competitors_{jt}^{own} + \mathbf{x}_{ijt}\lambda + \psi_j + \tau_t + u_{ijt}. \end{aligned} \tag{6}$$

In this model, κ_r^{ind} (κ_r^{rival} and κ_r^{own}) measures the effect of entry of a competitor owned independently (owned by a rival chain and owned by the same chain, respectively) on the seat share of the rth ranked movie in a chain theater over and above its effect on the seat share of a movie whose ranking is below 50th captured by κ_0^{ind} (κ_0^{rival} and κ_0^{own}). Vector $\mathbf{x}_{ijt}$ is the same as in model (5), including a constant, the movie ranking indicators, the demand share of the movie, and another indicator for vertical integration. For the same reason that we discussed in the previous section, we estimate model (6) using only monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period.[22]

The upper three panels in Figure 4 plot estimates of κ_r^{ind}, κ_r^{rival}, and κ_r^{own} for r from 1 to 50 along with 95 percent confidence bands.[23] They show that after entry of a competitor, a chain theater always reallocates seats across movies in such a way that the most popular

[21] Table A-1 presents the estimated effects of entry on the seat shares of the rth ranked movie in an incumbent theater, $\delta_0 + \delta_r$ for r from 1 to 30 as well as results of the significance tests.

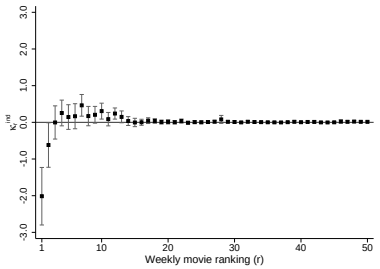
[22] We estimate the model with robust standard errors clustered by movie.

[23] The estimated effects of entry of an independent theater ($\kappa_0^{ind} + \kappa_r^{ind}$), a rival chain's theater ($\kappa_0^{rival} + \kappa_r^{rival}$), and a theater owned by the same chain ($\kappa_0^{own} + \kappa_r^{own}$) on the seat share of the rth ranked movie in an incumbent chain theater for r from 1 to 30 are reported in Table A-2.

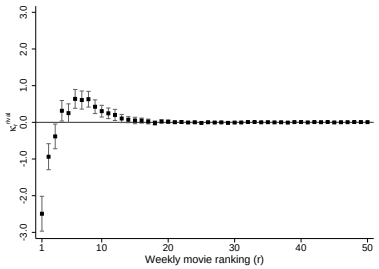
Figure 4: The effects of entry of different types of theaters on a theater's seat allocation

Panel A: Changes in a chain theater's seat shares

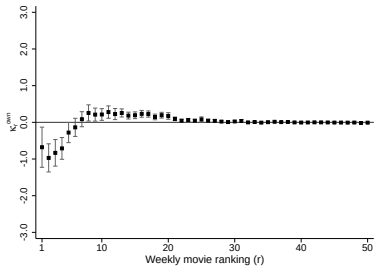
(i) After entry of an independent theater



(ii) After entry of a rival chain's theater

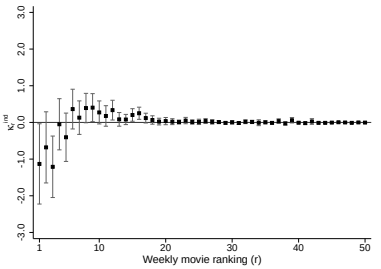


(iii) After entry of the same chain's theater

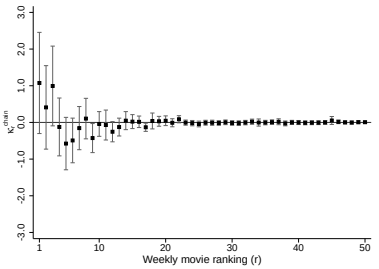


Panel B: Changes in an independent theater's seat shares

(i) After entry of an independent theater



(ii) After entry of a chain theater



Notes: The upper three panels of the figure present the effects of entry of (i) an independent theater, (ii) a rival chain's theater, and (iii) a theater owned by the same chain on an incumbent chain theater's seat allocation across movies of different weekly rankings. The bottom two panels present the effects of entry of (i) an independent theater and (ii) a chain theater on an incumbent independent theater's seat allocation across movies of different weekly rankings. Monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period are used in the estimation.

movies are given less seats than before regardless of the ownership of the competitor. For example, after a rival chain theater's entry, the seat share of the highest ranked movie decreases by 2.5 percent point, whereas the seat share of the 10th ranked movie increases by 0.3 percent point.

We repeat the analysis for incumbent independent theaters, separating the effects of entry of theaters that are (i) owned independently and (ii) owned by chains.[24] The estimates plotted in the bottom two panels of Figure 4 show that whereas an independent theater

[24]The estimated effects of entry of an independent theater and a chain theater on the seat share of the rth ranked movie in an incumbent independent theater for r from 1 to 30 are reported in Table A-3.

tends to reallocate seats from the most popular movies to the less popular ones when the new theater is independently owned, there is weak evidence that it reallocates in the other direction after entry of a chain theater. This may suggest that an independent theater tries to improve the quality of its movie portfolio when facing a strong new competitor.[25]

5 Robustness

In this section, we check the robustness of our findings in the following ways. First, we examine the short-run effects of entry and exit. Second, instead of the number of theaters in a local market, we use their screen counts to measure the degree of competition in the market. Lastly, we address a potential endogeneity concern in the analysis of seat allocation.[26]

Short-run effects of entry and exit

The analyses in the previous sections pool observations from different periods into the same data set, while assuming symmetric effects of entry and exit. The first robustness check is to separately measure the short-run effects of entry and exit. To estimate the short run effects of entry, we use only observations from a window of six weeks before and after entry e in the following specification:

$$y_{et} = \theta_0 + \theta_1 Entry_t + \psi_e + u_{et}, \tag{7}$$

where $t \in \{-6, -5, \cdots, 4, 5\}$. We use three variables as the dependent variable one by one: (i) movie variety in local market, (ii) movie variety in an incumbent theater, and (iii) similarity between a pair of theaters.[27] Indicator $Entry_t$ is equal to zero when time t occurs before entry of a new theater, i.e. when $t < 0$ and one otherwise. Its coefficient, θ_1, captures the change in the dependent variable after entry. To study the short run effects of exit, we use observations from a window of six weeks before and after each exit, and replace $Entry_t$ with a similarly defined exit indicator $Exit_t$.[28]

Estimation results are reported in Table 6. On the whole, the short-run effects of entry and exit on variety and differentiation are consistent with previous findings. We find no evidence that entry or exit affects an incumbent theater's movie variety in the short-run.

[25]Independent theaters are usually smaller in size and managed less efficiently than chain theaters (Kim and Nora, 2017).

[26]As an additional robustness check, we consider larger local markets, that is, a circle of two mile radius around each theater, and examine how sensitive our findings are to the change. Estimation results reported in the last two columns in Table A-4 and plotted in Figure A-4 are similar to our previous findings.

[27]The similarity is calculated for each pair of theaters in the district where entry e takes place.

[28]There are few cases where multiple theaters enter in rapid succession, causing overlapping event windows. We omit these cases.

However, the short-run effects of entry and exit on market movie variety, 2 and -2.1, are significant at the 1 percent level and symmetric. We also find that similarity between a pair of theaters decreases when a new theater opens in the market but increases after exit of a theater, although the two short run effects are asymmetric.

To look closely at the timing of the change in variety and similarity, we replace $Entry_t$ with a set of time dummies that measure variety (or similarity) relative to the 6 weeks prior to entry (or exit). The upper two panels of Figure 5 show that the market-level variety sharply increases (decreases) when entry (exit, respectively) occurs, while there seems to be no clear change in theater-level movie variety as the two panels in the middle show. According to the bottom two panels, the similarity between a pair of theaters immediately increases after exit of a theater, whereas the decrease in the similarity after entry is less obvious. Also, note that there is no pre-entry or pre-exit trend in most cases, alleviating the concern that entry or entry may be endogenous, with the exception where the similarity shows a decreasing trend before exit. In such a case, we may underestimate the increase in similarity after exit.

Screen counts

So far we have measured the degree of competition in a local market by the number of theaters in the market. A weak point of this approach is that we cannot distinguish entry of a larger competitor from entry of a smaller one. To address this issue, we replace the number of theaters (or the number of competitors) with their screen counts in the regression models.

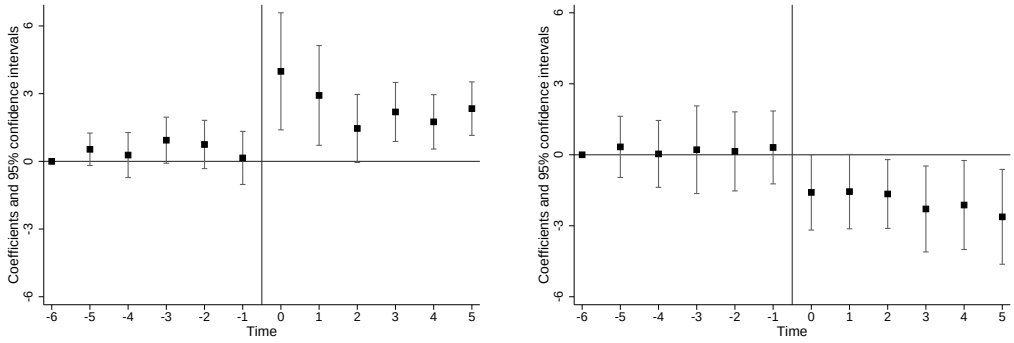
The changes in seat shares of movies in independent and chain theaters after entry of a competitor presented in Figure A-2 are qualitatively the same as previous ones found in the main section. When facing a new competitor, a chain theater always allocates fewer seats to a handful of the most popular movies than before but more seats to the less popular ones. An independent theater is less likely to reallocate its seats in response to entry.

As for the impact of entry on movie variety, estimates in Table A-5 show that the number of movies playing in a local market increases by 2.9 when a new theater with 10 screens opens in the market. Also, the effect of a chain theater's entry is approximately the same as that of an independent theater's entry if their screen counts are the same. Hence, the difference in the effects of entry of chain and independent theaters presented in Table 3 is mostly due to the difference in their sizes. Table A-6 reports the effect of entry on movie variety in an incumbent theater. Again, we find that the effect of entry is relatively modest compared to its impact on market-wide movie variety.

Figure 5: Short-run effects of entry and exit

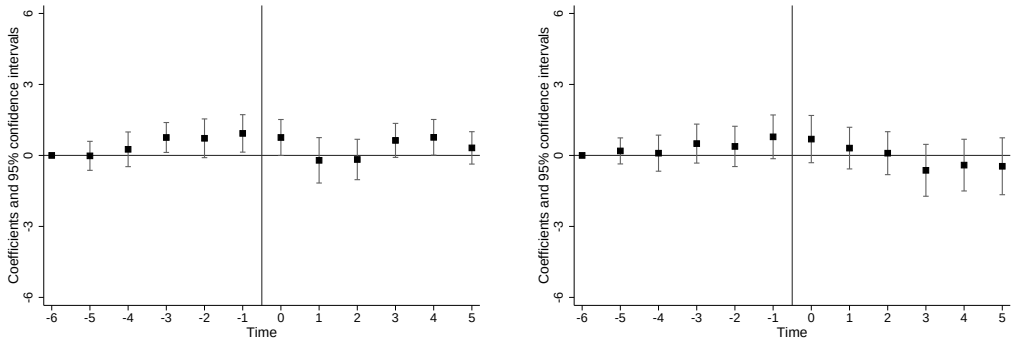
Panel A: The effects of entry and exit on market-level movie variety

(i) Entry (ii) Exit



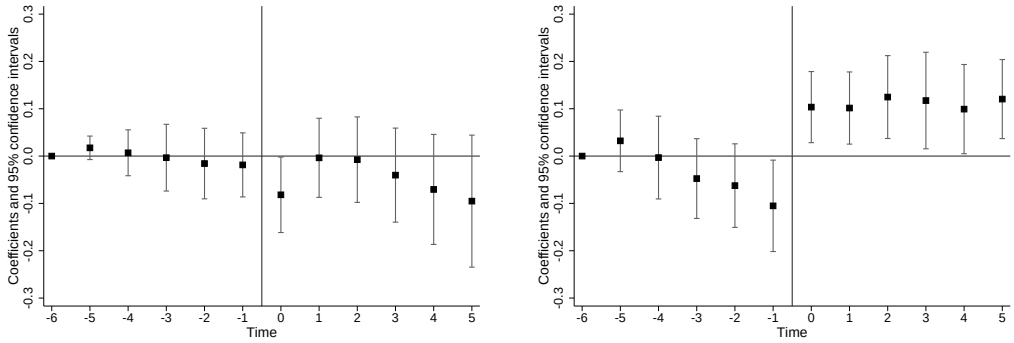
Panel B: The effects of entry and exit on theater-level movie variety

(i) Entry (ii) Exit



Panel C: The effects of entry and exit on differentiation

(i) Entry (ii) Exit



Notes: The Figure shows estimated variety and similarity at time t for $t \in \{-5, -4, \cdots, 4, 5\}$ relative to the 6 weeks prior to entry (or exit) along with 95 percent confidence bands.

Weekend seat allocation

There is a potential endogeneity concern in our analysis of seat allocation using models (5) and (6). That is, the weekly demand share of a movie may be affected by how many seats are allocated to the movie by theaters during the week. If the demand for a movie in a theater exceeds the number of seats allocated to the movie in the theater, then the observed audience size would be underestimating the real demand of the movie. We address the concern by exploiting the separation of weekday (Monday through Thursday) and weekend (Friday through Sunday) movie audience sizes in our data. Since movie demand is much lower on weekdays than on weekends, the weekday audience size is much less likely to be affected by theaters' seat allocations than the weekend audience size.[29] Moreover, a theater's decision on weekend seat allocation is based on the movie demand during the preceding weekdays.[30] Therefore, we analyze the effect of entry on a theater's weekend seat allocation using the weekday demand shares and movie rankings that are based on the weekday audience sizes.

In addition to alleviating the endogeneity concern, this approach has the advantage of focusing on the competition effect when screening schedule matters the most and seats for some movies are easily sold out.

The estimation results summarized in Figure A-3 are similar to those in the main section. The weekend seat shares of the most popular movies decrease in a chain theater after entry of a competitor, and correspondingly those of the remaining less popular movies increase. An independent theater does so when the new competitor is also independently owned. On the contrary, when the new competitor belongs to a chain, it shows a (weak) tendency to increase the seat shares of the most popular movies on weekends.

6 Conclusions

In this paper, using rich panel data on weekly screening schedules of theaters and their entry/exit history, we study the effect of entry on an incumbent theater's decision on seat allocation across movies as well as movie differentiation and variety.

The movie variety analysis shows that the more theaters in a local market, the more movies playing in the market, while there is no strong evidence that movie variety in an incumbent theater is affected by entry of competitors. In addition, the similarity between a pair of theaters in a local market decreases after entry. Altogether, these findings suggest

[29] In our data, the average daily audience size on weekdays, 270 thousand, is less than half of that on weekends, 560 thousand.

[30] One disadvantage of this approach is that it may underestimate the audience size of newly released movies, as most movies are released on Wednesday or later.

that a theater may use differentiation to moderate competition and enjoy the agglomeration benefits without bearing the burden of increasing movie variety in the theater.

The analysis of seat allocation shows that when confronting a new competitor, an incumbent theater tends to decreases the seat shares of a handful of the most popular movies while increasing those of the remaining less popular movies. Considering theaters' screening schedules overlap less in less popular movies, the result implies that theaters may differentiate themselves by playing more of less popular movies.

Our findings are consistent with those in the previous work on product differentiation and variety. Moreover, this paper complements those works by providing a more comprehensive view on the non-price effects of competition. What is missing from our analysis is an implication of entry for consumer welfare. Increased movie variety in a local market after entry of theaters into the market may positively affect the consumer welfare by attracting consumers whose favorite movies were not played before. Quantifying the welfare effect would be an interesting topic for future research.

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Table 1: Summary information for the key variables

Variables	Avg.	Std. Dev.	Min.	Max.	Obs.
Panel A. District level (86 districts)					
Number of movies	12.89	4.38	1	46	17,082
Number of theaters	1.97	1.24	1	8	17,082
Panel B. Theater level (248 theaters)					
Number of movies	9.48	3.71	1	23	13,355
Number of screens					
- Independent theaters	7.08	2.85	1	15	13,355
- Chain theaters	7.97	2.18	2	16	25,638
Number of competitors					
- Independent theaters	2.24	2.55	0	11	13,355
- Chain theaters	1.43	1.85	0	10	25,638
· Competitors of the same chain	0.18	0.41	0	2	25,638
Similarity between a pair of theaters	0.81	0.19	0	1	29,463
Panel C. Theater-movie level (1,761 movies)					
Seat allocation	840	2,991	0	119,645	2,682,424
Seat share (%)	1.45	4.91	0	100	2,682,424

Table 2: Numbers of theaters and districts

	Theater	District	
Condition		All	Oligopoly
Total	248	86	58
# Entry ≥ 1	83	41	22
# Exit ≥ 1	79	28	17
min{# Entry, # Exit} ≥ 1	113	51	27

Table 3: Entry and market-level movie variety

Variable	(1)	(2)	(3)	(4)
Theaters	1.731	1.796		
	(0.237)***	(0.241)***		
Theaters^{ind}			1.38	1.453
			(0.294)***	(0.282)***
Theaters^{chain}			1.948	2.075
			(0.272)***	(0.281)***
Constant	6.124	6.799	6.351	6.969
	(0.499)***	(0.531)***	(0.514)***	(0.540)***
Fixed effects				
Market	Yes	Yes	Yes	Yes
Year	Yes	-	Yes	-
Week	Yes	-	Yes	-
City*Time	-	Yes	-	Yes
R-squared	0.421	0.626	0.424	0.630
Number of markets	86	86	86	86
Observations	17,082	17,082	17,082	17,082

Notes: The table presents OLS estimates using the number of movies playing in a local market (district) as the dependent variable. Standard errors (clustered by market) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 4: Entry and theater-level movie variety

	All theaters		Chain theaters		Independent theaters	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Competitors	0.056	0.040				
	(0.076)	(0.080)				
Competitors^{ind}			-0.024	0.217	0.042	0.185
			(0.299)	(0.420)	(0.136)	(0.188)
Competitors^{rival}			0.334	0.627	-0.106	-0.084
			(0.469)	(0.530)	(0.159)	(0.221)
Competitors^{own}			1.801	1.701		
			(0.507)***	(0.624)***		
Opening week	-1.359	-1.499	-0.514	-0.912	-1.069	-1.360
	(0.460)***	(0.458)***	(0.760)	(0.754)	(1.229)	(1.793)
Closing week	-3.073	-3.046	-0.033	1.043	-2.794	-2.726
	(0.385)***	(0.378)***	(0.665)	(0.338)***	(0.856)***	(0.764)***
Constant	8.813	9.393	9.090	9.730	7.809	7.857
	(0.201)***	(0.222)***	(0.270)***	(0.268)***	(0.231)***	(0.467)***
Fixed effects						
Market	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	-	Yes	-	Yes	-
Week	Yes	-	Yes	-	Yes	-
City*Time	-	Yes	-	Yes	-	Yes
R-squared	0.299	0.522	0.383	0.652	0.161	0.571
Number of theaters	248	248	70	70	32	32
Observations	38,993	38,993	12,440	12,440	4,486	4,486

Notes: The table presents OLS estimates using the number of movies playing in a theater as the dependent variable. The first two columns use all observations, while the next four columns use only observations of monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period. Standard errors (clustered by theater) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 5: Entry and movie differentiation

Variable	(1)	(2)	(3)	(4)
Theaters	-0.060	-0.045		
	(0.017)***	(0.011)***		
Theaters^{ind}			-0.089	-0.070
			(0.015)***	(0.012)***
Theaters^{chain}			-0.023	-0.008
			(0.017)	(0.011)
Constant	0.822	0.852	0.885	0.858
	(0.034)***	(0.019)***	(0.028)***	(0.015)***
Fixed effects				
Theater pair	Yes	Yes	Yes	Yes
Year	Yes	-	Yes	-
Week	Yes	-	Yes	-
City*Time	-	Yes	-	Yes
R-squared	0.314	0.413	0.335	0.422
Observations	29,463	29,463	29,463	29,463

Notes: The table presents OLS estimates using the similarity between a pair of theaters as the dependent variable. Standard errors (clustered by market) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table 6: Short-run effects of entry and exit

	Market variety		Theater variety		Similarity	
Variable	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Entry	1.992	(0.519)***	-0.095	(0.268)	-0.047	(0.028)*
Exit	-2.144	(0.642)***	-0.385	(0.243)	0.145	(0.026)***
R-squared	0.630		0.783		0.312	
Number of events						
Entry	43		58		43	
Exit	33		42		31	
Observations	839		1,191		2,847	

Notes: The table presents OLS estimates using (i) market-level movie variety, (ii) theater-level movie variety, and (iii) similarity as the dependent variable. Standard errors (clustered by event) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

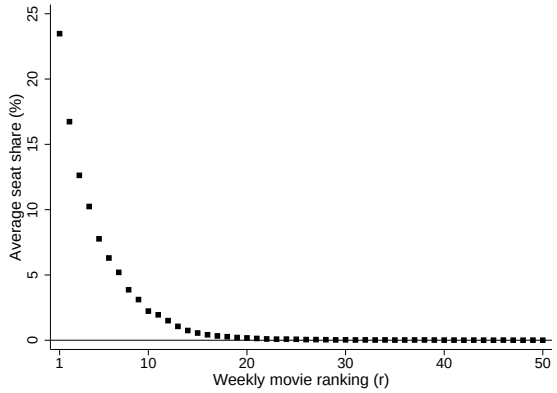
Appendix

Movie screenings within and across theaters

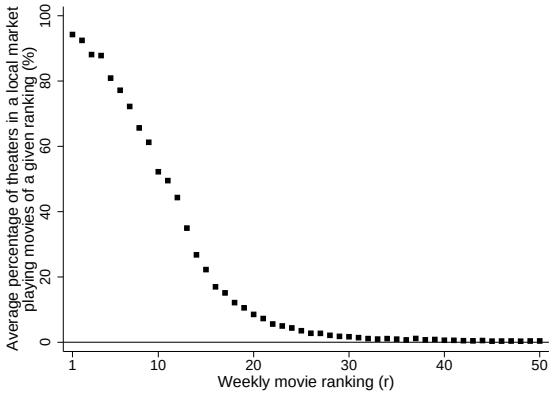
In Figure A-1, we document movie screenings within and across theaters. The left panel presents the average seat shares of movies of different weekly rankings. Not surprisingly, the higher the ranking of a movie is, the more seats are allocated to the movie in a theater. For instance, the highest ranked movie takes 23 percent of the total seating capacity of a theater on average, while almost no seats are allocated to a movie whose ranking is below 20th. For each market (district) with two or more theaters, we calculate the percentage of theaters that play movies of a given weekly ranking. The right panel plots the average percentages for different weekly rankings. As expected, theaters' screening schedules overlap less in movies of lower rankings: on average, fewer than 10 percent of theaters in an oligopoly market are playing the 20th ranked movie, whereas the highest ranked movie is available in almost all theaters.

Figure A-1: Movie screenings within and across theaters

(i) Seat shares of movies of different rankings in a theater



(ii) Percentages of theaters in an oligopoly market playing movies of different rankings



Notes: The left panel of the figure presents the average seat shares of movies of different weekly rankings. The right panel plots the average percentages of theaters in an oligopoly market playing movies of different rankings.

Table A-1: The effect of entry on an incumbent theater's seat allocation

r	Change	F-stat	p-value
1	-0.259	42.415	0.000
2	-0.165	22.695	0.000
3	-0.124	18.934	0.000
4	-0.087	12.528	0.000
5	-0.039	3.018	0.083
6	-0.041	4.422	0.036
7	-0.027	1.974	0.160
8	0.027	2.879	0.090
9	0.025	3.021	0.082
10	0.028	4.064	0.044
11	0.017	1.896	0.169
12	0.013	1.513	0.219
13	0.039	11.407	0.001
14	0.035	12.972	0.000
15	0.034	11.504	0.001
16	0.030	11.941	0.001
17	0.022	6.091	0.014
18	0.028	11.587	0.001
19	0.024	8.939	0.003
20	0.025	8.632	0.003
21	0.023	6.462	0.011
22	0.016	4.137	0.042
23	0.024	8.627	0.003
24	0.019	5.025	0.025
25	0.020	5.238	0.022
26	0.017	4.607	0.032
27	0.020	5.463	0.020
28	0.018	5.289	0.022
29	0.010	1.821	0.177
30	0.011	1.986	0.159
R-squared			0.715
Observations			2,682,424

Notes: The table presents estimated effects of entry on the seat shares of the rth ranked movie in an incumbent theater for r from 1 to 30 as well as results of the significance tests.

Table A-2: The effect of different types of new theaters' entry on a chain theater's seat allocation

	Type of the new theater								
	Independent theater			Rival chain theater			Same chain theater		
r	Change	F-stat	p-value	Change	F-stat	p-value	Change	F-stat	p-value
1	-2.010	25.762	0.000	-2.494	106.721	0.000	-0.673	5.848	0.016
2	-0.614	4.007	0.045	-0.940	27.214	0.000	-0.963	24.958	0.000
3	0.002	0.000	0.995	-0.387	5.186	0.023	-0.826	20.124	0.000
4	0.260	2.112	0.146	0.313	4.881	0.027	-0.704	21.887	0.000
5	0.149	0.776	0.378	0.247	3.670	0.056	-0.273	3.836	0.050
6	0.171	0.975	0.324	0.637	23.747	0.000	-0.131	1.085	0.298
7	0.469	9.861	0.002	0.605	23.396	0.000	0.091	0.738	0.390
8	0.175	1.721	0.190	0.627	33.236	0.000	0.262	5.491	0.019
9	0.211	3.320	0.069	0.423	19.484	0.000	0.217	5.558	0.019
10	0.311	7.975	0.005	0.301	13.418	0.000	0.220	7.157	0.008
11	0.091	0.968	0.325	0.243	10.422	0.001	0.285	10.510	0.001
12	0.245	9.924	0.002	0.199	6.353	0.012	0.232	8.396	0.004
13	0.154	3.471	0.063	0.102	2.861	0.091	0.262	19.135	0.000
14	0.040	0.423	0.516	0.068	2.302	0.129	0.190	13.127	0.000
15	0.001	0.000	0.987	0.047	0.964	0.326	0.199	14.356	0.000
16	0.007	0.022	0.882	0.044	1.221	0.269	0.238	20.315	0.000
17	0.051	1.508	0.220	0.019	0.256	0.613	0.232	23.019	0.000
18	0.042	1.612	0.204	-0.020	0.344	0.558	0.153	11.635	0.001
19	0.013	0.195	0.658	0.021	0.524	0.469	0.201	18.610	0.000
20	0.018	0.344	0.558	0.015	0.267	0.605	0.180	12.808	0.000
21	0.008	0.086	0.769	-0.001	0.000	0.989	0.099	8.127	0.004
22	0.040	1.691	0.194	0.006	0.060	0.807	0.050	2.752	0.097
23	-0.005	0.071	0.790	-0.007	0.083	0.773	0.070	4.798	0.029
24	0.011	0.192	0.661	-0.002	0.007	0.936	0.052	3.190	0.074
25	0.006	0.071	0.790	-0.018	0.657	0.418	0.085	4.137	0.042
26	0.013	0.413	0.521	-0.001	0.001	0.970	0.051	2.903	0.089
27	0.023	1.115	0.291	-0.007	0.105	0.746	0.047	2.735	0.098
28	0.085	2.253	0.134	-0.004	0.028	0.868	0.027	1.061	0.303
29	0.021	1.011	0.315	-0.017	0.618	0.432	0.013	0.253	0.615
30	0.015	0.564	0.453	-0.009	0.152	0.697	0.030	1.348	0.246
R-squared									0.822
Observations									875,989

Notes: The table reports estimated effects of entry of an independent theater, a rival chain's theater, and a theater owned by the same chain on the seat share of the rth ranked movie in an incumbent chain theater for r from 1 to 30 as well as results of the significance tests. Monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period are used in the estimation.

Table A-3: The effect of different types of new theaters' entry on an independent theater's seat allocation

	Type of the new theater					
	Independent theater			Chain theater		
r	Change	F-stat	p-value	Change	F-stat	p-value
1	-1.131	4.127	0.042	1.071	2.324	0.128
2	-0.680	1.903	0.168	0.405	0.482	0.488
3	-1.210	8.041	0.005	0.989	3.171	0.075
4	-0.050	0.016	0.899	-0.128	0.101	0.751
5	-0.404	1.447	0.229	-0.582	2.444	0.118
6	0.363	1.771	0.183	-0.496	2.495	0.114
7	0.130	0.338	0.561	-0.160	0.272	0.602
8	0.392	3.816	0.051	0.100	0.116	0.733
9	0.403	4.429	0.035	-0.432	4.026	0.045
10	0.273	2.979	0.085	-0.047	0.063	0.801
11	0.176	1.554	0.213	-0.076	0.120	0.729
12	0.335	6.079	0.014	-0.258	2.637	0.105
13	0.084	0.831	0.362	-0.131	0.836	0.361
14	0.080	1.293	0.256	0.044	0.093	0.760
15	0.203	5.332	0.021	0.017	0.022	0.883
16	0.250	8.672	0.003	0.012	0.012	0.915
17	0.118	2.878	0.090	-0.137	2.257	0.133
18	0.067	1.293	0.256	0.035	0.067	0.796
19	0.023	0.275	0.600	0.026	0.068	0.794
20	0.036	0.575	0.448	0.041	0.176	0.675
21	0.021	0.290	0.590	-0.014	0.023	0.878
22	0.010	0.179	0.673	0.081	0.896	0.344
23	0.051	1.238	0.266	-0.010	0.016	0.899
24	0.012	0.180	0.672	-0.024	0.092	0.762
25	0.015	0.211	0.646	-0.047	0.340	0.560
26	0.037	0.958	0.328	-0.013	0.025	0.874
27	0.015	0.274	0.600	-0.013	0.028	0.866
28	0.009	0.211	0.646	-0.020	0.068	0.794
29	-0.011	0.036	0.849	-0.002	0.001	0.980
30	0.003	0.062	0.804	-0.020	0.066	0.798
R-squared						0.578
Observations						288,615

Notes: The table reports estimated effects of entry of an independent theater and a chain theater on the seat share of the rth ranked movie in an incumbent independent theater for r from 1 to 30 as well as results of the significance tests. Monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period are used in the estimation.

Table A-4: The effect of entry on an incumbent's movie variety under alternative local market definitions

	District		A circle of 2 mile radius	
Variable	(1)	(2)	(3)	(4)
Competitors	0.032	0.032	0.010	-0.014
	(0.066)	(0.070)	(0.058)	(0.066)
Opening week	-1.358	-1.498	-1.357	-1.497
	(0.460)***	(0.458)***	(0.460)***	(0.458)***
Closing week	-3.069	-3.044	-3.069	-3.041
	(0.385)***	(0.378)***	(0.385)***	(0.378)***
Constant	8.844	9.396	8.872	9.494
	(0.187)***	(0.221)***	(0.227)***	(0.260)***
Fixed effects				
Market	Yes	Yes	Yes	Yes
Year	Yes	-	Yes	-
Week	Yes	-	Yes	-
City*Time	-	Yes	-	Yes
R-squared	0.299	0.522	0.299	0.522
Number of markets	248	248	248	248
Observations	38,993	38,993	38,993	38,993

Notes: The table presents OLS estimates using the number of movies playing in a theater as the dependent variable. Districts are defined as local markets in the first two columns, whereas in the next two columns we set a circle of two mile radius around a theater as its local market. Standard errors (clustered by theater) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table A-5: The effect of entry on movie variety in a local market using screen counts as measures of market structure

Variable	(1)	(2)	(3)	(4)
Screens	0.275	0.293		
	(0.032)***	(0.032)***		
Screens^{ind}			0.285	0.290
			(0.037)***	(0.035)***
Screens^{chain}			0.275	0.293
			(0.032)***	(0.032)***
Constant	5.629	6.17	5.567	6.181
	(0.482)***	(0.503)***	(0.505)***	(0.515)***
Fixed effects				
Market	Yes	Yes	Yes	Yes
Year	Yes	-	Yes	-
Week	Yes	-	Yes	-
City*Time	-	Yes	-	Yes
R-squared	0.441	0.645	0.441	0.645
Number of markets	86	86	86	86
Observations	17,082	17,082	17,082	17,082

Notes: The table presents OLS estimates using the number of movies playing in a local market (district) as the dependent variable. *Screens* is the total number of screens in the market. Standard errors (clustered by market) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table A-6: The effect of entry on an incumbent's movie variety
using screen counts as measures of market structure

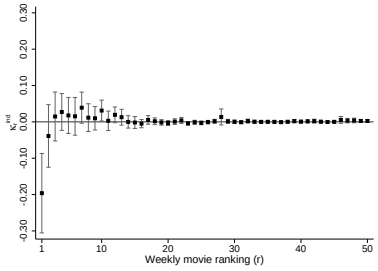
	All theaters		Chain theaters		Independent theaters	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Cscreens	0.006	0.004				
	(0.010)	(0.011)				
Cscreens^{ind}			0.016	0.076	-0.012	0.012
			(0.035)	(0.039)*	(0.034)	(0.052)
Cscreens^{rival}			0.041	0.080	-0.011	-0.008
			(0.057)	(0.066)	(0.022)	(0.030)
Cscreens^{own}			0.228	0.217		
			(0.037)***	(0.047)***		
Opening week	-1.359	-1.498	-0.528	-0.923	-1.056	-1.329
	(0.460)***	(0.458)***	(0.760)	(0.755)	(1.226)	(1.790)
Closing week	-3.072	-3.046	-0.032	1.050	-2.789	-2.723
	(0.385)***	(0.378)***	(0.666)	(0.340)***	(0.856)***	(0.762)***
Constant	8.837	9.412	9.082	9.692	7.822	8.071
	(0.188)***	(0.218)***	(0.269)***	(0.249)***	(0.229)***	(0.461)***
Fixed effects						
Market	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	-	Yes	-	Yes	-
Week	Yes	-	Yes	-	Yes	-
City*Time	-	Yes	-	Yes	-	Yes
R-squared	0.299	0.522	0.384	0.653	0.161	0.570
Number of theaters	248	248	70	70	32	32
Observations	38,993	38,993	12,440	12,440	4,486	4,486

Notes: The table presents OLS estimates using the number of movies playing in a theater as the dependent variable. *Cscreens* is the number of competitors' screens. The first two columns use all observations, while the next four columns use only observations of monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period. Standard errors (clustered by theater) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

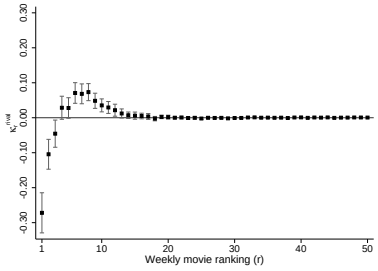
Figure A-2: The effects of entry of different types of theaters on a theater's seat allocation using screen counts as measures of market structure

Panel A: Changes in a chain theater's seat shares

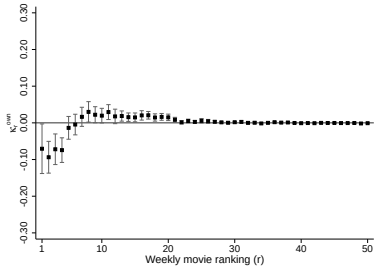
(i) After entry of an independent theater



(ii) After entry of a rival chain's theater

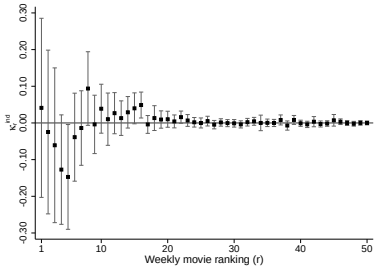


(iii) After entry of the same chain's theater

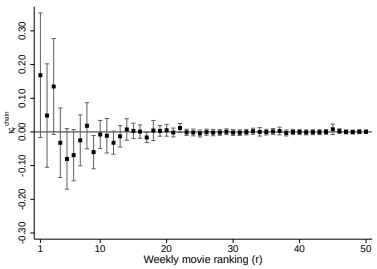


Panel B: Changes in an independent theater's seat shares

(i) After entry of an independent theater



(ii) After entry of a chain theater

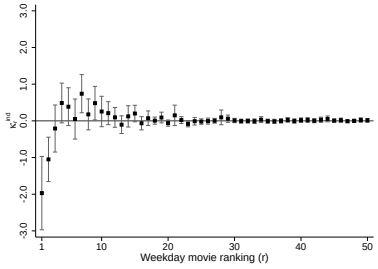


Notes: The upper three panels of the figure present the effects of entry of (i) an independent theater, (ii) a rival chain's theater, and (iii) a theater owned by the same chain on an incumbent chain theater's seat allocation across movies of different weekly rankings. The bottom two panels present the effects of entry of (i) an independent theater and (ii) a chain theater on an incumbent independent theater's seat allocation across movies of different weekly rankings. Screen counts are used as measures of market structure in the analysis. Monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period are used in the estimation.

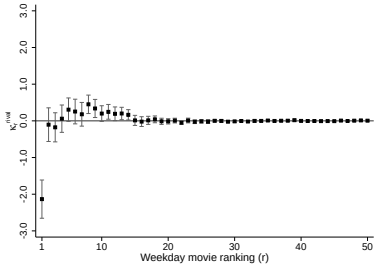
Figure A-3: The effects of entry of different types of theaters on a theater's seat allocation using weekday audience sizes and weekend seat allocations

Panel A: Changes in a chain theater's seat shares

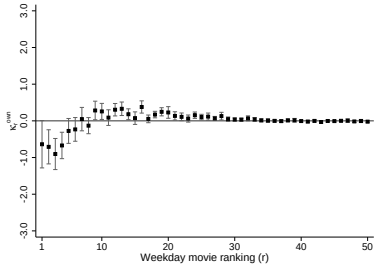
(i) After entry of an independent theater



(ii) After entry of a rival chain's theater

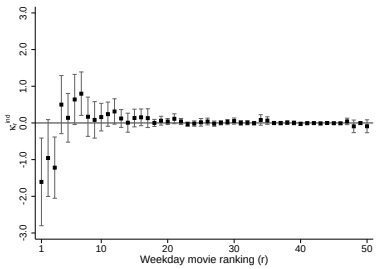


(iii) After entry of the same chain's theater

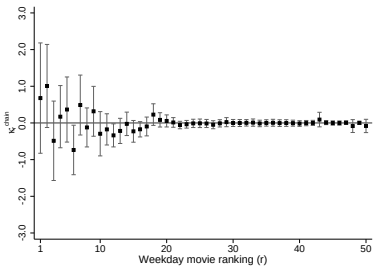


Panel B: Changes in an independent theater's seat shares

(i) After entry of an independent theater



(ii) After entry of a chain theater

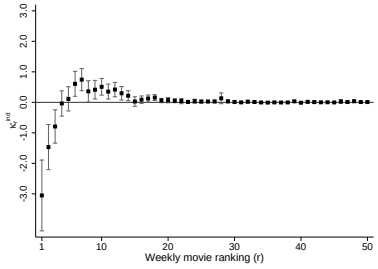


Notes: The upper three panels of the figure present the effects of entry of (i) an independent theater, (ii) a rival chain's theater, and (iii) a theater owned by the same chain on an incumbent chain theater's weekend seat allocation across movies of different weekday rankings. The bottom two panels present the effects of entry of (i) an independent theater and (ii) a chain theater on an incumbent independent theater's weekend seat allocation across movies of different weekday rankings. Monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period are used in the estimation.

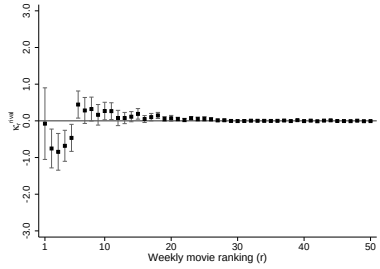
Figure A-4: The effects of entry of different types of theaters on a theater's seat allocation setting a circle of two mile radius as the local market

Panel A: Changes in a chain theater's seat shares

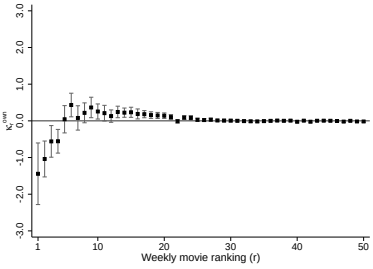
(i) After entry of an independent theater



(ii) After entry of a rival chain's theater

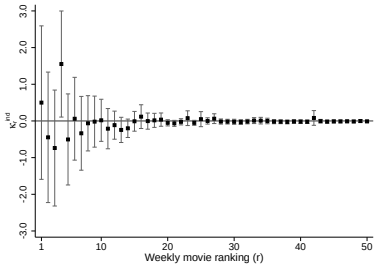


(iii) After entry of the same chain's theater

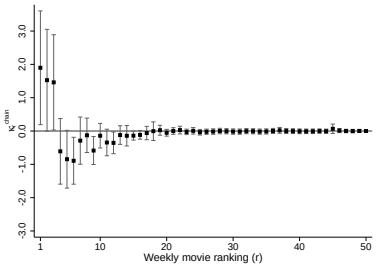


Panel B: Changes in an independent theater's seat shares

(i) After entry of an independent theater



(ii) After entry of a chain theater



Notes: The upper three panels of the figure present the effects of entry of (i) an independent theater, (ii) a rival chain's theater, and (iii) a theater owned by the same chain on an incumbent chain theater's seat allocation across movies of different weekly rankings. The bottom two panels present the effects of entry of (i) an independent theater and (ii) a chain theater on an incumbent independent theater's seat allocation across movies of different weekly rankings. A circle of two mile radius around a theater is set as its local market. Monopoly theaters that experience entry of a rival, duopoly markets that become monopolies after exit of a theater, and markets that stay as monopolies during the sample period are used in the estimation.