Vertical Foreclosure with Product Choice and Allocation: Evidence from the Movie Industry

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Abstract

We investigate a vertically integrated theater's contract and screen allocation decisions in the movie industry characterized by quality unpredictability, price uniformity, and revenue-sharing contracts. Based on a simple theoretical model that describes the decisions of theaters and movie distributors, we derive two mechanisms of foreclosure behaviors: selection and allocation foreclosure. Our empirical results suggest that integrated theaters not only impose a higher quality standard for movies from independent distributors at contracts but also screen their affiliated movies more even after contract. Vertically integrated theaters' favoritism toward its affiliated movies are more pronounced at company-owned theaters than franchised theaters. Further, we also find integrated theaters' favorable treats for their rival movies compared to independent movies as well as non-linearity of the foreclosure effects across movie quality and seasonality.

Keywords: Endogenous Product Characteristics, Movie Industry, Quality Unpredictability, Revenue-Sharing Contract, Vertical Integration
JEL Classification: L13, L22, L40, L82

1 Introduction

How does foreclosure work when a vertically integrated firm cannot change its final product price? Most previous studies have examined the impacts of vertical foreclosure on price and its welfare implication. However, the same logic cannot be applied to the movie industry where the movie ticket price is fixed.[1]

This paper shows theoretically that vertically integrated theaters in the movie industry foreclose the rival's movies through product choice and allocation. Then testable implications derived in a simple theoretical model are applied to Korean movie data. Empirically, we find that even though vertically affiliated movies have lower quality, vertically integrated theaters offer more chance of showing a movie to them, which we define as *selection foreclosure*. They also allocate more screening times to their affiliated movies, which we define as *allocation foreclosure*. In other words, vertical integration affects movie portfolios in terms of quality and diversity at theaters. We also find that the degree of foreclosure differs by movies' quality, seasonality (peak vs. non-peak seasons) and organizational structure (company owned vs. franchisee theaters).

Empirically examining firms' endogenous product choice or allocation is not an easy problem because of firms' simultanenous decision of product choice and price. However, owing to price stickiness of the movie industry, distributors and theaters take the price as exogenously given. This enable us to sidestep firms' price setting decision and focus on firms' movie choice and allocation decision.

Moreover, we take advantage of two unique features in the Korean movie industry in addition to utilizing the fixed price of a final product, i.e., movie ticket price. The first feature in the Korean movie industry is that the revenue share ratio in contracts between distributors and theaters is the same across movies and theaters. Revenue-sharing contracts with different ratios is a common form in many other countries (Gil, 2009; Gil and Lafontaine, 2012). Typically, when a movie is expected to be a box-office hit, the distributor of that movie claims a higher revenue share and an exhibitor's screening cost increases. Therefore, the revenue-sharing ratio affects an exhibitor's movie selection and allocation decisions. At the same time, the negotiated revenue-sharing ratio itself is endgoenously determined by taking into account an exhibitor's decision. In this aspect, the fixed revenue-sharing ratio of movie contacts in Korea helps us avoid the endogeneity problem and makes a reduced-form approach sufficient for the analysis. The second feature of the Korean movie industry is that there exists a one-week mandatory

[1] The movie ticket price is the same regardless of its popularity and regardless of weekdays or weekends. Orbach and Einav (2007) and Einav (2007) call the former as the movie puzzle and the latter as the show-time puzzle.

screening period by law. Once exhibitors have a contract with a new movie, they must run that movie for the first week of opening on the designated screen; they cannot renegotiate during the first week or allocate a designated screen to another movie.

With these two unique characteristics in the Korean movie industry, exhibitors' contract and screen allocation decisions for a new movie in the first week of opening rest purely on the relationship between exhibitors and distributors as well as the *ex-ante* prediction of movie quality (or popularity). Therefore, after controlling the quality of a movie, we can attribute differences in contract of screen allocation across integrated and non-integrated movies to their vertical integration structure.

Controlling quality can be an issue, because it is well known in the movie literature that the quality of movies is extremely uncertain and unpredictable. We conceptually define *ex-ante* quality as the quality the insiders of the movie industry predict before the actual release of a movie, while *ex-post* quality as the quality realized after its release when consumers' preferences are revealed. These two qualities can be quite different because movies are experience goods and extreme uncertainty dominates the market. In the first week, as *ex-post* quality is yet to be realized, the first week's movie schedule of the exhibitor is solely based on *ex-ante* quality. Thus, by focusing on the first week movie schedule, we only have to control *ex-ante* quality. We measure *ex-ante* quality by constructing a news-based measure in the spirit of Baker et al. (2016). Also, using panel structure, we also can control quality by using movie fixed effects. Using either the news-based measure or movie fixed effects, we obtain the similar results.

This paper contributes to three strands of literature. First, it broadens the existing vertical integration literature by investigating how vertical integration affects firms' product choice and allocation. While many existing empirical papers such as Hastings (2004), Hastings and Gilbert (2005) and Hortaçsu and Syverson (2007) focus on price changes resulting from vertical integration, our paper examine quality channel.[2]

Second, this paper also contributes to the literature of endogenous product choice and characteristics (Mazzeo, 2002; Fan, 2013; Eizenberg, 2014). Studying firms' endogenous product choice entails many challanges, but one of the main problems is the endogeneity issue resulting from firms' simultanenous decision of product choice and price. It often requires the use of full structural models to identify the extent to which vertical integration affect product choice. However, using special features of the Korean movie industry, we suggest reduced form evidences of how vertical integration affects firms' endogenous product choice and characteristics. Orhun et al. (2015) studies the impact of local competition on exhibitors' movie choice, but we studies how vertical integration

[2]For more detailed survey, refer to Lafontaine and Slade (2007).

affect exhibitors' movie choice and screen allocation decisions.

Last but not least, this paper is also related to an empirical literature on the movie industry such as Fu (2009), Gil (2009), and Hwang (2013) that examined vertical integration in the movie industry. These studies find that integrated theaters favor their own movies. However, our paper is different from Fu (2009) and Hwang (2013) in that we take care of the endogeneity issue using the unique characteristics of the Korean movie industry as well as the *ex-ante* quality of movies. Our paper also has different viewpoint from Gil (2009). He suggests vertical integration as a solution for incentive misalignment problem between distributors and exhibitors created by revenue-sharing contract, which is from the perspective of a profit maximizing distributor. On the other hand, our paper focuses on an exhibitor's different treatment across movies under screen constraint. Moreover, we consider quality unpredictability by using our news-based measure, which is pointed in De Vany and Walls (2004), Waldfogel (2017), and Aguiar and Waldfogel (2016).

The remainder of this paper is organized as follows. In the following section, we describe the institutional background, features and contracts between distributors and exhibitors in the Korean movie industry. Section 3 constructs a theoretical model to examine the vertical foreclosure behavior of exhibitors and derives two main hypotheses. In Section 4, we describe our data and variables. Section 5 presents the empirical framework and results. The conclusion is in Section 6.

2 The Movie Industry

2.1 General Features and Contracts of the Movie Industry

The movie industry mainly consists of three stages: production, distribution, and exhibition.[3] Producers contract with downstream distributors for the right to distribute a specific movie, and distributors contract with exhibitors (theaters) to decide the number of screenings, screen allocation, and run length of a movie. While distributors handle other tasks including release date, marketing, and promotion, negotiating with exhibitors on the number of screenings and duration is one of their most significant tasks.

The universal features of the movie industry are price uniformity and quality unpredictability. The ticket price is fixed despite differences in quality, timing of release, or seats (Orbach and Einav, 2007). On the contrary, consumer demand and product perfor-

[3]Refer to Eliashberg et al. (2006), Filson et al. (2005), and Gil (2007) for more details on the movie industry in general, Hwang (2013) and Kim and Nora (2017) for details on the Korean movie industry.

mance are extremely uncertain as people discover their preferences through the process of consumption and "word-of-mouth" recommendations (De Vany and Walls, 1999, 2004). Thus, movie production faces unpredictable demand and high risk, while it incurs large investment costs.[4] Therefore, vertical integration arrangements have naturaly emerged in the movie industry.[5]

Meanwhile, Dana and Spier (2001) and Cachon and Lariviere (2005) point out that demand uncertainty is one of the reasons for the widespread reliance on revenue-sharing contracts in vertically separated industries. The movie industries in many countries such as Singapore, Spain, and the U.S. indeed use revenue-sharing contracts between exhibitors and distributors that stipulate specific shares of box office revenue. Gil (2009) suggests that revenue-sharing contracts help address the incentive alignment problem between distributors and exhibitors. Distributors that find the run length of their movie would be shorter than they wish may give away a higher share to an exhibitor in order to lengthen it. Or exhibitiors that want to show a box-office hit expected movie at their theaters may offer a higher share to its distributor. As a matter of fact, revenue shares tend to differ for each movie-theater combination and change over time.[6] Gil and Lafontaine (2012) provides empirical evidence that the distributors' share decreases as the run length of a movie increases and is smaller when the success of a movie is more uncertain.

2.2 Distinct Features of the Korean Movie Industry

The Korean movie industry has two unique contractual features compared with those in other countries.[7] First, the share of distributors is fixed regardless of movie characteristics, number of screenings, or duration. Conventionally, the distributor's share is 50% for domestic movies and 60% for U.S. movies. Second, the law requires exhibitors to allocate one whole screen to each movie at least for the first one week. That is, no other movies can be played on the screen originally designated to another movie and exhibitors cannot stop playing those contracted movies before the first week ends.[8] However, after the first week, a new contract can be negotiated and the minimum length law is no longer binding, as in other countries.

[4] Quality unpredictability is discussed in Section 2.3.

[5] For instance, the U.S. movie industry once had full integration from production through to distribution and exhibition until major studios were required to divest their theaters and prohibited from block booking by the U.S. Supreme Court (see De Vany and McMillan (2004)). Meanwhile, many other countries such as Spain, Singapore, and Japan still maintain vertical integration arrangements.

[6] The distributors' share usually declines from 60% to 40% over tiem (Gil, 2009).

[7] For more details on the Korean movie industry, refer to Appendix II.

[8] The purpose of this regulation is to protect independent movies.

This exogenously given sharing rule in Korea allows us to be free from the endogeneity issue in examining theaters' movie choices and screen allocation especially in the first week of the opening of a movie. When such shares are "endogenously" determined across movies as well as over time by renegotiation, it also affects exhibitors' movie choice and how many times the movie is screened. So, empirical studies need to control the share ratios of each movie-theater to examine the impacts of vertical integration. However, since contracts are proprietary, the terms of contracts are considered insider information and it is difficult for researcher to access those data (Prieto-Rodriguez et al., 2015). By taking advantage of the exogenously imposed fixed share and first week minimum run length restrictions in Korea, we can interpret different movie choices and screen allocations between integrated and non-integrated exhibitors purely as the effects of vertical integration after controlling the quality of a movie.

2.3 Measuring *Ex-ante* Movie Quality

Unpredictability of product quality (or popularity) is a generic feature of cultural goods (Waldfogel, 2017). In a recent study, Aguiar and Waldfogel (2016) recovers a quality prediction of new music from the estimated demand model using record label and other variables that explain consumer's demand. So their quality measure is based on realized market shares. Our focus is, however, on exhibitors' movie choice and screen allocation determined *before* the movie is released when exhibitors do not know exactly how many moviegoers would watch the movie. If the quality measure based on relized market share is considered as *ex-post* measure, exhibitors' quality prediction before its release can be described as *ex-ante* quality measure.

So, instead of realized number of audience or revenue, we use news intensity of a movie before its release as a proxy for *ex-ante* quality measure that exhibitors take into account in contracting with distrubutors. News intensity is likely to be higher when a distributor spends huge amount of money in marketing their movies or publicizing their movies through media. At the same time, moviegoers' interests and expectation on a movie may be reflected in news intensity. So the higher the news intensity, either supply-side or demand-side, for a movie is likely to be positively correlated with its success, i.e., *ex-post* high quality or popularity of a movie. Therefore, news intensity can be employed as a proxy for *ex-ante* quality for exhibitors to judge the success of a movie with. To measure the news intensity, we collect data on the number of news articles posted online for each movie, from Korea's largest search engine *Naver*. We limit the period of news intensity to one week to one month before the movie release to avoid measurement error and endogeneity problems.[9] The period was selected because in Korea, distributors and exhibitors usually sign a contract about one week before the actual release of a movie, which is also before the news intensity is affected by exhibitors' marketing activities. By doing this, we avoid the endogeneity problem that occurs when both news intensity of a movie and its screen allocation are influenced by exhibitors.

3 Theoretical Framework

We construct a simple static model with one exhibitor and two distributors A and B to explore the product choice of a vertically integrated exhibitor in signing a contract and allocating screens.[10] Suppose distributor A is vertically integrated with the exhibitor, whereas distributor B is independent. Let us assume that the revenue shares of the distributor and exhibitor for movie i are α_i and β_i, respectively; that is, $\alpha_i + \beta_i = 1$.

Figure 1 describes the game of this model. In the first stage, each distributor encounters movie i randomly and perceives the quality of movie i (Q_i) from an independent distribution, $F(Q_i)$, whose support is $\mathcal{D} \subset \mathbb{R}^+ \cup \{0\}$. All distributions are assumed to be identical across movies. However, they do not know the rival movie's exact quality and therefore cannot predict the exact number of screenings that would be allocated to their own movie.

Each distributor maximizes its expected profit based on the quality distribution and decides whether to distribute a movie in every period. For simplicity, we assume each distributor distributes only one movie at a time. Then, we obtain four possible cases: both distributors distribute movies; only one distributor, either A or B, distributes a movie; and no movie is distributed.

In the second stage, given the quality of the movie(s), the exhibitor makes two decisions: whether to sign contracts with A and/or B and, if contracted, how many screens to allocate to each movie. If movies A and B are distributed, the exhibitor has four options: exhibit both movies, exhibit movie A only, exhibit movie B only or exhibit no movies. These choice options arise from the movies' quality and fixed cost of exhibiting new movies, which we discuss in Section 3.1.

[9]For the robustness checks, we also used news intensity with different search periods. In general, expanding the period backward is likely to increase the possibility of including irrelevant news articles. Nevertheless, they provide similar results, which are available upon request.

[10]Refer to Appendix I for mathematical proofs

3.1 The Exhibitor's Problem

For the exhibitor's problem in the second stage of the game, we focus on the case that both distributors purchase and try to distribute their own movies, as our primary interest lies in the exhibitor's screen allocation across multiple movies.

We assume that after perceiving the qualities of two movies, Q_A and Q_B, the exhibitor allocates screens across movies, N_A and N_B, or decides to only show only one of the movies in order to maximize its profit as follows:[11]

$$\underset{N_A,N_B}{max}\ \pi_E[N_A; Q_A, Q_B] = \max[R^1, R^2, R^3] - F_E \quad \text{subject to } N_A + N_B = \bar{N} \tag{1}$$

where Q_i and N_i are the quality and number of screens allocated for movie i, respectively ($i = A, B$). Note that the exhibitor owns a limited number of screens, $\bar{N}$. F_E is the fixed cost for the exhibitor to operate a theater including the costs of managing a theater and selling tickets. R^1, R^2, and R^3 are the corresponding revenues of the exhibitor when the screens are allocated to two movies, movie A only, and movie B only, respectively, which are defined as follows:

$$\begin{aligned} R^1(Q_A, Q_B) &:= [R(N_A; Q_A) - C] + [\beta_B R(N_B; Q_B) - C] \\ R^2(Q_A, Q_B) &:= R(\bar{N}; Q_A) - C \\ R^3(Q_A, Q_B) &:= \beta_B R(\bar{N}; Q_B) - C \end{aligned}$$

where $R(N_i; Q_i)$[12] is the total sales revenue function from movie i and C is the fixed cost incurred by the exhibitor when playing a new movie (i.e., the cost of updating the movie schedule, changing movies, printing new posters or brochures).[13] β_i is the exhibitor's share of the total sales revenue from movie i. Note that $\beta_A = 1$ as the distributor and exhibitor of movie A are vertically integrated.[14] On the contrary, as movie B is from independent distributor B, the exhibitor receives only a proportion of its total sales revenue.

Assumption 1. *(i) $R(N_i; Q_i)$ is a strictly increasing and concave function*[15] *of N_i such that $\lim_{N_i \to 0} R_N(N_i; Q_i) = \infty$ and $\lim_{N_i \to \infty} R_N(N_i; Q_i) = 0$, where $R_N(\cdot; Q_i) =$*

[11] Showing no movie (i.e., having no revenue) is excluded, as the exhibitor then earns zero or even negative profits.

[12] In the revenue function, we normalize the price of tickets to 1 because this is fixed in the movie industry.

[13] We ignore marginal costs which are negligible compared with the fixed cost in the movie industry.

[14] For notational convenience, hereafter, we omit the notation of β_A by assuming it to be 1.

[15] Strict monotonicity and concavity imply continuity, so that $R(\cdot; Q_i)$ is continuous in N_i.

$\partial R(\cdot;Q_i)/\partial N_i$ *and* $R(0;Q_i)=0$ *for all* Q_i*;*

(ii) For every $Q_i \in \mathcal{D}$*,* $\beta_i R(\bar{N};Q_i) > C$*;*

(iii) $R(N_i;Q_i)$ *is strictly increasing in* Q_i*;*

(iv) $R(N_i;Q_i)$ *is continuously twice differentiable and* $\frac{\partial^2 R(\cdot;\cdot)}{\partial N_i \partial Q_i} > 0$.[16]

Assumption 2. *The cumulative distribution function of* Q_i *is strictly increasing and continuous, and* $\mathcal{D} = \mathbb{R}^+ \cup \{0\}$.

Assumption 1(i) assumes the strict concavity of $R(\cdot;\cdot)$, which ensures that theaters allocate their screens across movies, not solely to one movie when multiple movies are available. For instance, even when the expected box office performance of a specific movie such as *Titanic* exceeds that of other movies, theaters do not generally allocate all their screens solely to one movie. A small proportion of screens still tend to be allocated to other movies. Assumption 1(ii) implies that the exhibitor always has an incentive to exhibit a movie because the revenue can cover the fixed cost of doing do, C.[17] Assumption 1(iii) implies that movies with higher quality attract a larger audience. Assumption 1(iv) states the marginal revenue of screening increases in quality. Assumption 2 is the distributional assumption on the cumulative distribution function of Q_i, which is flexible in the sense that we do not impose any specific distribution function.[18]

Further, we define the sets of movie i's quality given the rival movie's quality as follows:[19]

$$\begin{aligned}
&\mathcal{S}^{ij}(Q_j) : \text{(the set of movie } i\text{'s quality given } j\text{'s quality when both movies are exhibited)}\\
&\mathcal{S}^{i0}(Q_j) : \text{(the set of movie } i\text{'s quality given } j\text{'s quality when only movie } i \text{ is exhibited)}\\
&\mathcal{S}^{0j}(Q_j) : \text{(the set of movie } i\text{'s quality given } j\text{'s quality when only movie } j \text{ is exhibited)}
\end{aligned} \tag{2}$$

For instance, $\mathcal{S}^{BA}(Q_A)$ is the set of independent movie quality Q_B, given vertically integrated movie quality Q_A when the exhibitor decided to play both movies to maximize its profit. By setting, $\mathcal{S}^{ij}(Q_j)$, $\mathcal{S}^{i0}(Q_j)$ and $\mathcal{S}^{0j}(Q_j)$ are disjoint.[20]

[16] This implies that for every N_i, $R_N(N_i;\cdot)$ is a strictly increasing function of Q_i and for every Q_i, $R_Q(\cdot;Q_i)$ is a strictly increasing function of N_i.

[17] This assumption is imposed to simplify the analysis. According to this assumption, when only one movie is distributed, the exhibitor always exhibits that movie regardless of its vertical relationship with the distributor.

[18] We do not impose any specific distributional function on Q_i, while Gil and Lafontaine (2012) assume that Q_i follows a uniform distribution.

[19] These are also defined mathematically in the Appendix.

[20] Given any Q_i, $\mathbb{P}[\mathcal{S}^{ji}(Q_i) \bigcup \mathcal{S}^{j0}(Q_i) \bigcup J^{0i}(Q_i)] = \mathbb{P}[\mathcal{S}^{ji}(Q_i)] + \mathbb{P}[\mathcal{S}^{j0}(Q_i)] + \mathbb{P}[\mathcal{S}^{0i}(Q_i)] = 1$ for $i,j=$

For movie B to be screened by the exhibitor, the quality of movie B needs to satisfy $Q_B \in \mathcal{S}^{BA}(Q_A) \cup \mathcal{S}^{B0}(Q_A)$, given Q_A. Hence, $\mathbb{P}[\mathcal{S}^{BA}(Q_A) \cup \mathcal{S}^{B0}(Q_A)]$ is the probability of movie B being exhibited given the rival movie's quality, Q_A. Similarly, $\mathbb{P}[\mathcal{S}^{AB}(Q_B) \cup \mathcal{S}^{A0}(Q_B)]$ is the probability of movie A being exhibited given the rival movie's quality.

The exhibitor's movie choice under its contract and screen allocation decisions can be summarized by the following lemma.

Lemma 1. *Suppose both distributors' movies have the same quality, that is, $Q_A = Q_B = \bar{Q}$.*[21] *Under Assumptions 1 and 2,*

(i) (Allocation Foreclosure) Suppose the integrated exhibitor decides to exhibit both movies. Then, it allocates more screens to the affiliated distributor's movie A, that is, $\hat{N}_A(\bar{Q}, \bar{Q}) > \hat{N}_B(\bar{Q}, \bar{Q})$ where $(\hat{N}_A(\bar{Q}, \bar{Q}), \hat{N}_A(\bar{Q}, \bar{Q}))$ is the optimal allocation of the exhibitor given $(\bar{Q}, \bar{Q})$;

(ii) (Selection Foreclosure) The probability of integrated movies being exhibited is higher than that of non-integrated movie being exhibited. That is, $\mathbb{P}[\mathcal{S}^{AB}(\bar{Q}) \bigcup \mathcal{S}^{A0}(\bar{Q})] \geq \mathbb{P}[\mathcal{S}^{BA}(\bar{Q}) \bigcup \mathcal{S}^{B0}(\bar{Q})]$.

Here, we conceptually separate exhibitors' screening optimization problem into two steps: choosing a subset of movies from the whole set of distributed movies to screen and optimizing the screen allocation across selected movies.[22] Lemmas 1(i) and (ii) imply two types of vertical foreclosure by the integrated exhibitor. We define the former as *allocation foreclosure* because the exhibitor is more favorable to the integrated distributor's movie in allocating screens. We define the latter as *selection foreclosure* because the integrated exhibitor requires a higher quality standard for the non-integrated distributor in signing a contract. That is, a non-integrated distributor with a higher quality movie can be excluded or *ante-contract* foreclosed from signing a contract with the exhibitor (i.e., contract foreclosed). These lemmas are tested and supported empirically in Section 5.

A, B.

[21] See the Appendix for the proof of Lemma 1.

[22] This problem can be constructed as a one-step decision since the exhibitor not choosing a certain movie is equivalent to a "zero" screen allocation for that movie. However, the significance of a non-zero screen allocation, even if it is very small number, is different from that of a zero screen allocation since a movie, once screened, can expect to benefit from word-of-mouth effects. Such effects play an important role in movie sales, being especially important for the success of small independent movies. Therefore, we separate the decision steps into contract and allocation.

3.2 Distributors' Problems

In the first stage, distributors decide whether to purchase the distribution right of a movie. This is a complicated decision since marketing a movie requires huge investment in addition to demand uncertainty and high risk. Distributors will not take a risk unless the return is sufficiently large to cover their costs. Under complete information on the quality of movies, distributors A and B maximize their profits by comparing their shares of revenue with the costs of purchasing and distributing a movie (F_D), which are as follows:

$$\begin{aligned} \text{Non-integrated distributor: } & \max \pi_{D_B} = \max\left[\alpha_B R(N_B; Q_A, Q_B) - F_D, 0\right],\ 0 < \alpha_B < 1 \\ \text{Integrated distributor: } & \max \pi_{D_A} = \max\left[R(N_A; Q_A, Q_B) - F_D, 0\right] \end{aligned}$$

However, we assume that each distributor has incomplete information on the exact quality of the rival movie. Hence, distributors do not know precisely whether they can make a contract with the exhibitor and/or how many screens might be allocated to their movie. Therefore, distributors maximize their expected profits and determine whether to buy the distribution rights. Here, we assume that distributors are risk-neutral and hence decide to distribute if their expected profit is greater than zero.[23]

We look for a Bayesian Nash equilibrium in which both distributors use cutoff strategies. We define cutoff quality $\hat{Q}_i$ as follows:

$$\hat{Q}_i := \inf\{Q_i \in \mathcal{D} : \mathbb{E}[\pi_{D_i}|Q_i] \geq F_D\}, \tag{3}$$

where $\mathbb{E}[\pi_{D_i}|Q_i]$ is distributor i's conditional expectation of its profit given quality Q_i. Distributor i distributes movie i only if $Q_i \geq \hat{Q}_i$. The features of this cutoff quality pair $(\hat{Q}_A, \hat{Q}_B)$ are characterized by the following proposition.

Proposition 1. *Suppose both players use cutoff strategies. Then, under Assumptions 1 and 2,*

(i) There exists a unique equilibrium in which each distributor uses a cutoff strategy, $\hat{Q}_i^*$;

(ii) For any (Q_A, Q_B) such that $Q_A = Q_B$, $\mathbb{E}[\pi_{D_A}|Q_A] \geq \mathbb{E}[\pi_{D_B}|Q_B]$ holds in the equilibrium;

(iii) $\hat{Q}_A^* \leq \hat{Q}_B^*$ in the equilibrium; and

(iv) The expected number of movies distributed by independent distributor B is lower

[23] Assuming that distributors are risk-averse does not qualitatively change our results if the degree of risk aversion is the same for both A and B.

than that distributed by integrated distributor A for any finite period.

Proposition 1(i) states that risk-neutral distributor i decides to distribute a movie as long as its quality is above the cutoff. If $Q_i < \hat{Q}_i$, the expected profit is insufficient to cover the fixed cost F_D and the distributor do not distribute a movie in that period. Proposition 1(ii) implies that even when each distributor observes a movie with the same quality, the expected profit of a vertically integrated distributor is higher owing to the vertical relationship: vertically integrated distributor A chooses whether to distribute by maximizing total movie sales revenue, while independent distributor B does so by maximizing a proportion of total movie sales revenue. Proposition 1(ii) leads to (iii). Given that every condition is the same, the cutoff quality of a movie is lower for a vertically integrated distributor.

In other words, there exist some movies with a certain range of quality that independent distributor B does not purchase, whereas vertically integrated distributor A does. This fact implies that when a movie is randomly observed by distributors, distributor B has less chance of distributing movies than distributor A. Therefore, as the period continues, the total number of movies distributed by distributor B will be lower than that by distributor A, which is suggested in Proposition 1(iv).

4 Data

4.1 Data Source and Variables

We use movie data obtained from the Korean Film Council (KOFIC) from 2008 to 2010, which include the screening schedules, ticket prices, and the box office revenue of all movies at all theaters nationwide.[24] During the sample period, around 1,300 movies were released. However, we restrict our sample to the top 300 movies based on audience size because the box office revenues of movies ranked below 300 are nearly zero (Figure 2).[25]

Table 1 lists the definitions of the variables used in the regression analysis. The two main dependent variables are $NScreenings_{ij}$ and $Contract_{ij}$. $NScreenings_{ij}$ is the

[24] According to *KOFIC*, the database, as of 2009, covers 99% of theaters and movies, or 100% when restricted to Seoul.

[25] Two movies with the wrong box office statistics and two other movies with large measurement errors in the number of news articles posted online are also excluded. Furthermore, the four movies released from December 25, 2007 (2010) to January 1, 2008 (2011) are dropped as our sample period of 2008–2010 does not fully cover the first week of their opening. Regarding theaters, we exclude 19 out of 245 theaters that have only one screen because our study focuses on the exhibitors' screen allocation problem. We also exclude additional two *Cine de Chef* theaters, a combined luxury movie theater and gourmet restaurant. Therefore, our sample data consist of 292 movies at 224 theaters.

number of screenings for movie i at theater j in the first week of movie i's opening, i.e., how many times a movie is shown. $Contract_{ij}$ is a binary variable that equals 1 if theater j screens movie i and 0 otherwise. Zero number of screenings implies that theater j did not sign a contract with the distributor of movie i.

To examine the impacts of vertical integration, which is our main interests, we include $Integ_{ij}$, that equals 1 when movie i is shown at its vertically integrated theater j. We also include the dummy variable, $Rival_{ij}$, that takes a value of 1 when vertically integrated theater j shows movie i from a vertically integrated rival distributor. The difference in the coefficients between $Integ_{ij}$ and $Rival_{ij}$ captures how differently vertically integrated theaters treat their affiliated movies and rival movies.

Furthermore, to take into account the types of vertically integrated theaters, we include $Comp\_Own_j$, which takes a value of 1 if a vertically integrated thater is a company-owned theater, 0 if it is a franchise theater. There are two types of vertically integrated theaters: company-owned theaters and franchised theaters. The property (theater) of the former belongs to the vertically integrated company while that of a franchised theater does not. At franchised theaters, the vertically integrated company allows the owner of the property, i.e., theater, to use a brand name of the multiplex chain by charging a franchise fee. Since franchised theaters receive know-hows, training, supports, etc., from the multiplex chain, they are more or less under the influence of the multiplex chain. However, since they pay a proportion of the revenue as a franchise fee, their profit function is likely to be more close to that of independent theaters than that of company-owned theaters. So franchised theaters may have weaker incentive alignment with the parent company than company-owned theaters may have (Hwang, 2013).

The variable $News_i$, that is the number of news article posted online for each movie from one week to one month before the movie release, is employed as a proxy of *ex-ante* quality of a movie, which was discussed in section 2.3.[26] To control strong seasonality in the movie industry, we include $Peak$ dummy that takes a value of 1 during the peak season and 0 otherwise.[27][28]

[26] We assume that exhibitors (or theaters) predict or estimate the quality or popularity of movie i and decide whether to sign a contract with its distributor. The *ex-post* quality that results in revenue is known after a movie is shown to the public. Cabral and Natividad (2016) also control for movie quality in a similar way; however, they use TV media exposure instead of news article exposure and do not differentiate *ex-ante* and *ex-post* quality.

[27] We consider July, August, December, and January as the peak season in which schools in Korea are in summer or winter vacations, many Korean people also have vacation, and the high portion of the total annual number of audience is concentrated.

[28] On average, 39.7% of total movies are distributed in peak seasons. Among movies from integrated distributors, 40.2% are distributed in peak seasons, and 39.5% of movies from independent distributors are distributed in peak seasons. 38.5% of U.S. movies, 38.8% of Korean movies, and 50% of movies from

In addition, we include characteristics of movie i such as running time of a movie, rating of a movie, nationality and genre dummy, and monthly fixed effects. The distributor dummy variables are also included to control for unobserved quality.[29]

4.2 Descriptive Statistics

Table 2 presents the descriptive statistics of theaters by integration status.[30] Columns 1 to 3 report the averages of the theater characteristics based on all 224 theaters and column 4 reports them based on the 160 theaters that operated continuously throughout the sample period.[31] Of the 224 theaters, 60.7% were vertically integrated, while the rest were independent. Vertically integrated theaters have slightly more screens and more seats than non-integrated theaters (statistically significant at the 1% level). And vertically integrated theaters showed 32 movies more than non-integrated theaters, i.e., integrated and non-integrated theaters showed 86.7% and 75.2% of the 292 movies, respectively. Moreover, the average number of screenings per movie, (AveScreenings_j), at integrated theaters (around 140.6 times) was 23.8% higher than that at non-integrated theaters. The same pattern holds in the number of screenings per movie in the first week of a movie opening: the average number of screenings per movie at integrated theaters was 29.5% higher than that at non-integrated ones. This finding suggests that integrated theaters with more screens and seats were able to show a greater variety of movies and allocate more number of screenings to each.

Table 3 presents the descriptive statistics of movie characteristics by the integration status of distributors and by nationality (or production origin). First, 71.9% of movies (210 of 292 movies) were distributed by 31 non-integrated distributors, while the rest were distributed by two vertically integrated distributors. The proportion of non-integrated movies was higher because foreign movies, which account for 65–80% of annual movie releases, were distributed by subsidiaries of foreign distributors.[32] Meanwhile, integrated distributors' movies attracted larger audience and generated more revenues. The attendance and average revenue of integrated distributors' movies were almost 2 and 1.73 times higher than those of non-integrated distributors' movies, respectively. An

other countries were distributed in peak seasons.

[29] For example, theaters may expect movies from large and/or integrated distributors to have higher quality, although their media exposure is the same with those from independent distributors.

[30] For more details on data, please refer to Appendix III.

[31] Since it is required for the all theaters to report their status and screening schedule to the KOFIC by the law, temporary or permanent shutdown of a theater can be easily inferred from its screening record.

[32] Hollywood movies have a large share of the Korean movie market and these are mostly distributed by subsidiaries of U.S. distributors. Of the 292 movies, 148 were Hollywood movies and 59% of U.S. movies were distributed by subsidiaries of foreign distributors.

integrated distributor's movie had a higher chance of being screened at theaters and a higher average number of screenings across theaters (AveScreenings$_i$). The same pattern holds in the number of screenings in the first week of opening. Hence, the success of integrated distributors' movies might come from the strategic behaviors of integrated distributors and exhibitors or from other elements of those movies lead to higher popularity. We investigate this further by using a regression approach in Section 5.

Second, if we classify movies by nationality, Korean movies were the most successful, achieving the highest audience size and revenue. The average number of screenings during both the whole screening period and the first week after release were higher for Korean movies than for foreign movies. This finding confirms that the Korean market is one of a few globally open film industries with competitive domestic movies.[33] Table 3 shows that Korean movies were more likely to be screened at a theater compared to U.S. movies. In addition, integrated distributors distributed Korean movies more (59.8%) than U.S. movies (24.4%). As before, this finding suggests that the success of Korean movies might have come from the strategic behaviors of integrated distributors and exhibitors. Figure 3 shows the number of news articles posted online for both U.S. and Korean movies. The *ex-ante* quality proxied by the amount of news is positively correlated with the *ex-post* quality proxied by audience size especially for Korean movies, although there are some outliers. Meanwhile, the average number of news articles posted online is significantly different between Korean and U.S. movies. Popularity of Korean movies or moviegoers' interests on Korean movies may lead to higher number of news article on a new Korean movie. We include the production origin dummy of a movie to control unobserved differences across movies depending on the production origin.

5 Empirical Methodology and Results

We test the two hypotheses on *selection foreclosure* and *allocation foreclosure* derived from the model in Section 3. The former hypothesis is that integrated exhibitors require higher quality for a competitor's movie in signing a contract and the latter hypothesis is that integrated exhibitors screen their affiliated movies more.

To investigate these foreclosure behaviors, we use the two unique features of movie contracts in Korea discussed in Section 2: fixed revenue sharing and the first week minimum run length restriction. Under these two exogenously given rules, the exhibitor's

[33]Considering that marketing strategies are almost identical between domestic and foreign movies, the greater popularity of Korean movies may due to the 'home bias': Korean people are more lenient to the quality of Korean movies.Park (2015) shows that imported movies that come from countries with a short cultural distance perform better in terms of Australian box-office.

problems of signing contracts and/or allocating screens in the first week are purely based on its relationship with the distributor of a movie as well as movie quality. Hence, after controlling the quality of a movie, we can interpret difference in movie choice and screen allocation as evidence of vertical foreclosure.

5.1 Testing Lemma 1(i, ii): Allocation and Selection Foreclosure

In this section, we test both the *allocation* and *selection* foreclosure. Our main specification to test *allocation* foreclosure is as follows:

$$NScreenings_{ij} = \mathbf{X}'_{it}\boldsymbol{\beta}_1 + \beta_2 Integ_{ij} + \delta_j + \epsilon_{ij}$$

The linear fixed-effect model is employed to eliminate the effects of unobservable theater-specific characteristics, δ_j. ϵ_{ij} is the error term. The regressors, $\mathbf{X}_{it}$, include characteristics of movie i such as news intensity($News_i$), running time of a movie($Runtime_i$), rating($NC17_i$), nationality and genre dummies, distributor dummy, and monthly fixed effects.[34] Lastly, as our main interest variable, we include the vertical integration dummy $Integ$.[35]

To examine *selection foreclosure*, we use the following probit model to explore how vertical integration affects the decision of an exhibitor in signing a contract with a distributor.

$$Contract_{ij} = \mathbb{1}\{\mathbf{X}_i\boldsymbol{\beta} + \mathbf{Z}_j\boldsymbol{\delta} + u_{ij}\}$$

The decision of theater j to sign a contract with movie i is modelled as a function of theater characteristics $\mathbf{Z}_j$ such as the number of screens($Screens_j$), the number of seats($Seats_j$) as well as movie characteristics $\mathbf{X}_i$. u_{ij} is the error term.

Table 4 shows consistent results across different specifications, confirming both *selection* and *allocation foreclosure* behavior of exhibitors. First, specifications (1) to (3) in table 4 show the results for the *allocation foresclosure*.[36] The coefficient of $Integ$is

[34]To capture the degree of spatial competition among theaters, as mentioned in Davis (2006) and Orhun et al. (2015), we also include a dummy variables $Mile_j$ (and $HMile_j$) which takes a value of 1 if there is at least one theater operating within 1 mile distance (and half a mile distance). The variation of this variable comes from theaters' entry and exit throughout our sample periods. However, we do not report the estimation results of those variables because the degree of spatial competition turned out to have little impacts on exhibitors' decision.

[35]For more details on the variables, refer to section 4.1.

[36]Specification (1) is the linear regression with movie fixed effects and theater fixed effects. Using movie fixed effects relieves the burden of measuring ex-ante quality of a movie unobservable to researcher. Instead of using movie fixed effects, specification (2) includes news intensity as a proxy for the quality of a movie, along with movie chacteristics variables. In specification (3), we carry out a Tobit regression because the number of screenings is always non-negative (i.e., censored below). In this model, we addi-

significantly positive at a size of ten across specifications. This implies that integrated exhibitors screen their affiliated movies about ten times more during the first week of release after controlling the quality of the movie as well as other characteristics. Given that the average number of screenings during the first week is 52.4, ten times more screening opportunities account for around 19.1% more chances of screening for a vertically integrated movie. Having more screenings in the first week is likely to augment the word-of-mouth effect that brings more audience and revenue.

Second, the results of the probit regression and the corresponding average marginal effects for *selection foreclosure* are shown in specifications (4) and (5), respectively. The coefficient of *Integ*is significantly positive. The average marginal effect of vertical integration in specification (5) implies that the chance of an integrated movie shown at its affiliated theater is on average 3 percentage points higher than that of non-integrated movies shown at the same theater.[37]

Third, the coefficient of *News* is significantly posivie across all the specifications. That is, the quality of a movie increases the number of screenings and the chance of signing a contract with an exhibitor.

5.2 Ownership Structure and Rivalry between Vertical Integration

This subsection further explores integrated exhibitors' foreclosure behavior from an ownership structure perspective and from an integrated distributor rively perspective. To examine the impact of ownership structure on vertically integrated theaters' foreclosure behavior, we include the interaction term, $Integ_{ij} * Comp\_Own_j$, which takes a value of 1 if a movie from an integrated distributor is shown at its company-owned theater, and 0 otherwise. The coefficient of this dummy variable captures different degree of foreclosure at franchised and company-owned theaters while the coefficient of $Integ_{ij}$ captures the degree of foreclosure at franchise-owned ones among vertically integrated theaters.

Table 5 shows the estimation result. Specificaitons (1)-(3) show the results for *allocation foreclosure*. The coefficients of $Integ*Comp\_Own$ are not only significantly positive, but also much larger than those of *Integ*. In specifications (1)-(2), franchised theaters of vertically integrated multiplex chains show their affiliatd movies 2.73-2.83 times more than non-affiliated movies. However, the company-owned theaters show their affiliated

tionally control for theater characteristics instead of using theater fixed effects. As theater characteristics, the number of screens, theater chain dummies, and location dummies are included.

[37] Simple descriptive statistics in Table 3 shows that the chance of integrated movies shown at a theater is around 6.7 percent points higher. After taking into account movie and theater characteristics, we find the favoritism for its own movie is reduced to around 3 percentage point difference in signing a contract.

movies 11.42-11.44 times more than the franchised theaters of the same chain.[38] In the Tobit specification (3), *allocation foreclosure* occurs only at company-owned theaters. These empirical evidence strongly supports our argument that franchised theaters has less incentive to behave like company-owned theaters. It is well known that in franchising literature, franchisees have incentive misalignment with franchisers and thus more likely to maximize their local profits.[39] Therefore, favarable treatment toward vertically affiliated movies are much stronlgy observed at company-owned theaters.

Meanwhile, the Probit result in specification (4) shows that the coefficient of *Integ* is positive, but not statistically significant. This implies that franchased theaters do not *selection foreclosure* non-affiliated movies. The coefficient of $Integ * Comp\_Own$ is also positive, but not signifciant. The sum of the coefficients, *Integ* and $Integ * Comp\_Own$ is around 0.27, which is close to the coefficient of *Integ* in specification (4) of Table 5. That is, *selection foreclosure* may occur at company-owned theaters, but not not statistically significant.

Now we turn to rivalry between two vertically integrated distributors in Korea. We investigate how a vertically integrated theater reacts to a vertically integrated rival distributor's movies. To capture this, we include the dummy variable, $Rival_{ij}$, which equals 1 if movie i is from an integrated distributor is shown at non-affiliated integrated thater j.

Table 6 shows that in specifications (1)-(5), the signs and magnitudes of all the coefficients are quantitatively very similar to the ones in Table 4. So let us focus on the $Rival_{ij}$ dummy variable. The coefficient of $Rival_{ij}$ is positively significant in specifications (1)-(3) while it is not in specification (4). This implies that vertically integrated theaters show its rival movies 3.70-4.74 times more than movies from independent distributors while they do not have any faverable treatment to rival mvies in singing a contract. The coefficient of $Integ_{ij}$ is similar to the ones in the previous analyses. It is interesting to find smaller but more favorable reaction to a vertically integrated rival distributor' movies than to independent distributors' movies in screen allocation.

To explore this further, we take into accout rivalry effect and ownership structure effect together. If there exists any favorable intention of a distributor or exhibitor to a rival distributor's movies, it may be more reflected at company-owned theaters' behavior than franchised theaters' behavior. Specifications (6)-(8) in Table 6 show that the coefficient of $Rival_{ij} * Comp\_Own_j$ is significantly positive while the coefficient of *Rival* becomes

[38]More precisely, company-owned theaters of vertically integrated multiplex chains show their affiliated movies 14.17 (2.73+11.44) to 14.25 (2.83+11.42) times more than other non-affiliated movies.

[39]See Blair and Lafontaine (2005), Kosová et al. (2013) and Lafontaine et al. (2016) for more details.

insignificant. This implies that vertically integrated theaters' favorable treatment toward its rival movies in terms of screen allocation are observed only at company-owned theaters. Compared to independent distributors' movies, company-owned theaters show their affiliated movies around 15.7 times more while screening their rival movies around 9.26-9.56 times more.[40] For each vertically integration, having favorable treatment toward each other may be mutually advatagenous in that they both have limited resources, i.e., theaters to show movies. Or there exists something that we could not capture with our models.[41] In any case, this result implies that independent distributors face even more disadvantages in screen allocation compared to vertically integrated distributors.

The results for selection forclosure in specifications (9)-(10) are also similar to the ones in (4) in Table 6. The sum of the coefficients, *Integ*and $Integ * Comp\_Own$ is 0.27, which is similar to 0.21 in specification (4), but statistically insignificant. Meanwhile, the sum of the coefficients, $Rival$ and $Rival * Comp\_Own$ is 0.15 (-0.26+0.41), which is positive but statistically insignificant.

5.3 Non-linear Foreclosure of Quality and Seasonality

We extend our analyses by incorporating nonlinearity of quality and seasonality into our two main empirical models. First, regarding the non-linear impacts of movie quality on foreclosure, we include the square temrs of *News* in addition to their interaction term with *Integ*.[42] Table 7 shows a nonlinear relationship between the number of screenings and *News*. For instance, in specification (1), for non-integrated movies, the number of screnings increase until the number of news reaches around 1,663 and then decreases.[43] Integrated movies also have a similar inverse U relationship between *News* and the number of screenings, but with a bit more steeper slope.[44] However, as shown in Figure 4, 95.5% of movies (279 out of 292 movies) have the number of news below 800 while

[40] In specifications (6)-(7), the company-owned theaters show affiliated movies 15.63 (11.88+3.85)-15.69 (11.89+3.80) times more than independent movies while franchised theaters show them 3.80-3.86.

[41] Research on alternative decision mechanism of theaters and distributors in this extent is left for future research.

[42] We statistically tested nonlinearity of *News* variable using the methodology developed by Baek et al. (2015) and Cho and Ishida (2012). We find that nonlinearity of *News* is statistically significant under the 5%significance level.

[43] For non-integrated movies, $\widehat{Y_{ij}} = \cdots - 0.11(News - 16.63)^2 + \cdots$. As the unit of the *News* variable is 100, the number of screenings for non-integrated movies is the highest when the number of news is 1,663 holding others constant.

[44] For integrated movies (when *Integ*=1), $\widehat{Y_{ij}} = \cdots - 0.28(News - 11.50)^2 + \cdots$. The number of screenings for integrated movies is the highest when the number of news is around 1,150 holding others constant.

the maximum number of news for a movie is 1,771.[45] Therefore, except some outliers, as a movie has higher quality or more exposure to news, more screening opportunities are allocated with a decreasing rate. We also obtain similar results in specification (3) for *selection foreclosure*. For most movies, as the number of news increases, the probability of signing a contract increases. These results are also shown at Figure 5 & 6.

Second, as pointed out by Einav (2007) and Corts (2001), the movie industry has strong seasonality and hence the degree of competition differs by season. To investigate how foreclosure effects vary with the degree of competition, the $Peak$ dummy and its interaction with *Integ* was used in specifications (4)-(6).[46] The coefficients of $Peak$ are significantly negative, which implies that, during the peak seasons, both the number of screenings and the probability to be shown at a theater for a movie decrease. Since more new movies hit theaters during peak seasons, it it likely to result in more fierce competition for contract and screen allocation.[47]

Moreover, the interaction terms between the *Integ* and *Peak* are significantly negative. This implies that the favoritism toward its vertically integrated movies and the degrees of *allocation* and *selection foreclosure* weaken when competition becomes more fierce. Figures 7 and 8 confirm differences in the number of screenings and the contract probability between integrated and non-integrated movies at vertically integrated theaters become smaller during peak seasons at any level of movie quality. Allocating screening times, even at the minimum level, to non-integrated movies is likely to result in more variety of movies at theaters. This may improve revenue by attacting more consumers with diverse tastes especially during the peak season.[48]

5.4 Robustness Check: Alternative Quality Measures and Subsample Analysis

We conduct three robustness checks by using alternative measures of movie quality, alternative dependent variable to the number of screenings, and subsamples of the data. First, We re-estimate our main empirical models (3) and (4) using two alternative quality measures. The first one is the standardized quality variable (Zscore) that recale the *News* variable to have mean zero and unit variance. The other one is the logarithm of total audience for each movie, which we considered as *ex-post* quality and didn't use in the main analyses due the reverse causality problem. Specifications (1)-(6) in Table 8 suggest

[45]Those 13 outliers are all Korean movies, and 7 of them (38.9%) are from integrated distributors. The high number of news is due to the fact that famous movies stars appear in these movies or these movies are filmed by famous directors such as *Cannes* film festival winner.

[46]We include the Peak dummy instead of the monthly dummy variables.

[47]Our data confirm that the peak season has more movie openings than the non-peak season.

[48]This also justifies our assumption that $\lim_{N_i \to 0} R_N(N_i; Q_i) = \infty$.

that the results on *allocation* and *selection foreclosure* are robust with those alternative measures.

Specifications (7) and (8) of Table 8 demonstrate our results using alternative dependent variable, called *Ratio*. It is a ratio of minutes allocated to a movie to the total minutes availabie for screening at a theater, multiplied with 100 for scaling. Under the assumption that a theater operates twelve hours a day and seven days a week, the maximum time (minutes) available at a theater in a week is $7 \times 720 \times$ the number of screens. The actual amount of time for a movie is the number of screenings *times* running time of the movie in a week. The results are qualitatively similar to our previous ones which used the number of screenings as a dependent variable.

Finally, Table 9 reports the results from subsample analysis. Out of the top 300 movies in terms of total audience in our empirical study, we narrow down our subsamples to the top 100 movies and the bottom 100 movies. We find evidence for *selection foreclosure* in the bottom 100 movies, but not in the top 100 movies (specification (4) vs. specification (8)). The result for *allocation foreclosure* is almost the same while its degree is a bit bigger for the top 100 movies than for the bottom 100 movies. This is consistent with the result in Section 5 in which we find that the foreclosure effect varies across different level of quality. We also narrow down subsamples to theaters which operated for the whole sample period and obtain similar results.

6 Conclusion

In this study, we develop a simple model to examine the movie choice of a vertically integrated exhibitor in terms of contract and screen allocation and provide empirical evidence of its foreclosure behavior, using Korean movie industry data. We take advantage of the two unique features of the Korean movie industry: (1) the distributors' fixed share of total revenue from a movie and (2) the first week minimum run length restriction. Those exogenously given features enable us to focus only on the vertical foreclosure effects after controlling for the quality of a movie.

Specifically, we derive two types of vertical foreclosure behaviors from the theoretical model: *selection foreclosure* and *allocation foreclosure*. The empirical results show that integrated theaters require higher quality for independent movies to sign a contract. Moreover, even after signing a contract, integrated theaters allocate more number of screenings to their own movies after controlling for quality. Furthermore, we find the nonlinear relationship between the magnitude of foreclosure and *ex-ante* movie quality. Hence, movies from independent distributors need a higher quality than movies from vertically integrated ditributors in order to be shown at vertically integrated theaters where vertically integrated theaters have 60.7% of market share in terms of the number of theaters in the Korean movie exhibition market. Further, once screening is determined, independent movies face harsher discrimination as quality rises. This may lead to deterioration in profitability of independent distributors and hence market exit. On the other hand, integrated distributors' share in terms of the number of movie releases is likely to grow over time.

In the Korean movie market, there has been growing criticism of intensifying screen oligopoly. Moviegoers have been complaining about slim choices on moives at multiplex theaters. Producers have blamed vertically integrated theaters for discrimination against independent movies, leading to the collapse of smaller distributors. Even the huge success of some Korean movies has been attributed to screen oligopoly. Our theoretical and empirical results suggest that those criticisms are not groundless. While discrimination or favoritism exists, we also acknowledge that those theoretical and empirical evidences can come purely from the static profit maximization of a vertically integrated firm without any anticompetitive strategy.

In addition, we focus on the popularity of a movie that leads to revenue by controlling *ex-ante* quality of a movie with news intensity. However, we do not consider quality from other angles such as artistic quality. Therefore, we did not address the issue related to low screening opportunity of a movie with higher artistic quality but low newsworthiness, which may worsen the situation.

This study provides a better understanding of not only the movie industry, but also other vertically related industries characterized by tdemand uncertainty, price uniformity, and revenue-sharing contracts. However, cautious interpretation is needed as the impacts of vertical integration on social welfare remain ambiguous. They depend not only on the different quality cutoff criteria between integrated and non-integrated movies, but also on the changes in the number of movie releases in the industry. While our study provides some evidence on the growing concentration of vertically integrated distributors in terms of the number of movie releases, it does not consider the growth of the industry itself. Therefore, further investigation by incorporating the dynamics of the industry is left for future research.

Tables

Table 1. List of Variables

Theater (j) characteristics variables

Screens	The number of screens a theater owns
Seats	Total number of seats a theater owns
Contract	The ratio of movies contracted by the theater j, out of 292 movies
Seoul	Takes a value of 1 if a theater j is located in Seoul, 0 otherwise
Comp_Own	Takes a value of 1 if a theater j is company-owned, 0 if franchised
Mindist	Minimum distance from a closest theater, in mile (average: 2.85)
Mile	Takes a value of 1 if there is at least one theater operating within 1 mile distance
HMile	Takes a value of 1 if there is at least one theater operating within half a mile distance

Movie (i) characteristics variables

Runtime	Running time of a movie i, in minutes
NC17	Takes a value of 1 if movie i is rated above 'Restricted' (Restricted in Korea correspond to NC17 rate in the U.S.)
Audience	Total number of audience the movie attracted (Million people)
Revenue	Total revenue the movie collected (Million dollars)
Contract	Ratio of theaters movie i was shown at, out of 224 theaters
News	The number of news articles about movie i posted on the website $Naver$, between one month and one week before its release.
Integ_Movie	Takes a value of 1 if movie i is distributed from an integrated distributor
Genre dummies	15 genres of movies, following the classification of the $KOFIC$.
Nationality dummies	Three nationality of movies (Korean, American, Other)
Distributor dummies	33 distributors, including two integrated distributors.

Main (in)dependent variables (ij)

NScreenings	The number of screenings allocated to movie i at theater j in the first week of movie i's opening.
Contract	Takes a value of 1 if a theater j screens movie i, 0 otherwise.
Integ	takes the value of 1 if the distributor of movie i is vertically integrated with theater j, 0 otherwise.
Rival	Takes a value of 1 if movie i is from an integrated distributor and shown at non-affiliated integrated thater j.

Table 2. Theater Characteristics by the Integration Status

	Unbalanced Panel			Balanced Panel
	All	Non-integrated	Integrated	All
Screens	7.567	7.148	7.838	7.756
	(2.461)	(2.942)	(2.059)	(2.397)
Seats	1296.6	1217.4	1347.8	1329.7
	(558.4)	(667.1)	(470.6)	(559.7)
Seoul	0.241	0.227	0.250	0.219
	(0.429)	(0.421)	(0.435)	(0.415)
Contract	0.822	0.752	0.867	0.847
	(0.180)	(0.253)	(0.0861)	(0.143)
AveScreenings_j	130.0	113.6	140.6	135.0
	(50.43)	(61.97)	(37.91)	(47.89)
AveScreenings_j	52.1	44.4	57.1	54.1
(First week)	(20.70)	(25.21)	(15.29)	(19.47)
N	224	88	136	160

Notes: 1. The average theater characteristics are reported. 2. The values in parentheses are the standard deviations. 3. Of the 224 theaters in the unbalanced panel, 60.7% are integrated theaters. Of the 160 theaters in the balanced panel, 58.1% are integrated theaters.

Table 3. Movie Characteristics by the Integration Status of Distributors and Nationality

	All Movies	Non-integrated Movies	Integrated Movies	Korean Movies	U.S. Movies	Others
Audience	1.428	1.177	2.071	1.723	1.317	0.788
	(1.693)	(1.455)	(2.052)	(1.857)	(1.651)	(0.601)
Revenue	8.646	7.172	12.42	10.23	8.137	4.756
	(10.61)	(9.618)	(12.01)	(10.92)	(11.00)	(3.692)
AveScreenings_i	130.9	113.8	174.6	165.1	114.0	77.73
	(101.5)	(87.37)	(120.2)	(109.2)	(93.17)	(53.28)
AveScreenings_i	52.40	48.83	61.55	60.71	49.22	34.60
(First week)	(24.47)	(22.21)	(27.43)	(19.09)	(26.72)	(17.54)
Contract	0.825	0.808	0.870	0.921	0.777	0.683
	(0.208)	(0.214)	(0.187)	(0.122)	(0.212)	(0.289)
News	247.2	195.8	378.5	520.2	65.64	71.00
	(308.6)	(271.6)	(355.4)	(312.9)	(108.3)	(102.3)
NC17	0.196	0.196	0.195	0.259	0.150	0.175
	(0.397)	(0.397)	(0.396)	(0.438)	(0.357)	(0.380)
Integ_Movie	0.281			0.424	0.174	0.257
	(0.450)			(0.494)	(0.379)	(0.437)
Runtime	112.2	111.9	112.9	114.1	111.6	107.0
	(17.07)	(17.41)	(16.16)	(13.55)	(19.51)	(14.94)
N	292	210	82	116	148	28

Notes: 1. The average movie characteristics are reported. 2. The values in parentheses are standard deviations.

Table 4. The Effects of Vertical Integration: Screen and Allocation Foreclosure

Foreclosure Type:	Allocation Foreclosure			Selection Foreclosure	
Specification:	(1) Linear	(2) Linear	(3) Tobit	(4) Probit	(5) Probit(AME)
Integ	10.14***	10.22***	10.38***	.21***	.03***
	(.90)	(.90)	(.91)	(.06)	(.01)
News		2.09***	2.12***	.06***	.01***
		(.08)	(.09)	(.01)	(.00)
Screens			7.35***	.24***	.04***
			(.44)	(.02)	(.00)
Movie FE	Y	N	N	N	N
Theater FE	Y	Y	N	N	N
N	59967	59967	59967	59967	59967
Adj R^2	.58	.36			

1. In specifications (1)-(3), the dependent variable is the number of screenings, and in specification (4), and (5), the dependent variable is a binary variable which equals 1 if a theater j exhibits a movie i. In specification (5), the average marginal effects of the probit regression is reported. 2. All specifications include movie characteristics such as genre, dummy for distributors, rating, and running time except for specification (1) in which movie fixed effects are used. In specifications (3)-(5), theater characteristics such as location, chain, and the number of screens are controlled. Monthly fixed effects are included in all the specifications. 3. The total number of observations is 59,967 and in the Tobit regression (specification 3), 10,329 samples were left-censored. 4. * $p<0.05$; ** $p<0.01$; *** $p<0.001$. 5. Robust standard errors clustered by theater are reported in parentheses.

Table 5. Ownership Structure and Foreclosure

Foreclosure Type:	Allocation Foreclosure			Selection Foreclosure	
Specification:	(1) Linear	(2) Linear	(3) Tobit	(4) Probit	(5) Probit (AME)
Integ	2.73*	2.83*	–.03	.13	.02
	(1.15)	(1.16)	(1.61)	(.09)	(.01)
Integ *Comp_Own	11.44***	11.42***	16.01***	.14	.02
	(1.36)	(1.37)	(2.00)	(.11)	(.02)
News		2.08***	2.11***	.06***	.01***
		(.08)	(.09)	(.01)	(.00)
Screens			7.32***	.24***	.04***
			(.44)	(.02)	(.00)
Movie FE	Y	N	N	N	N
Theater FE	Y	Y	N	N	N
N	59967	59967	59967	59967	59967
Adj R^2	.58	.36			

Notes: 1. The same as in Table 4. 2. The interaction term between the integration dummy and the company-owned theater dummy is included.

Table 6. Rivalry beween Vertically Integrated Distributors, Ownership Structure and Foreclosure

Foreclosure Type:	Allocation Foreclosure			Selection Foreclosure		Allocation Foreclosure			Selection Foreclosure	
Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Linear FE	Linear FE	Tobit	Probit	Probit(AME)	Linear FE	Linear FE	Tobit	Probit	Probit(AME)
Integ	11.50***	11.55***	11.47***	.21***	.03***	3.80**	3.85***	1.02	.12	.02
	(1.00)	(1.00)	(1.01)	(.06)	(.01)	(1.15)	(1.15)	(1.58)	(.09)	(.01)
Rival	4.74***	4.61***	3.70**	–.02	–.00	–1.28	–1.59	–5.20	–.26	–.04
	(1.36)	(1.36)	(1.41)	(.09)	(.01)	(1.80)	(1.79)	(2.70)	(.17)	(.03)
Integ						11.89***	11.88***	16.07***	.15	.02
*Comp_Own						(1.35)	(1.35)	(2.00)	(.11)	(.02)
Rival						9.29***	9.56***	13.70***	.41*	.07*
*Comp_Own						(1.88)	(1.88)	(3.56)	(.20)	(.03)
News		2.08***	2.12***	.06***	.01***		2.08***	2.12***	.06***	.01***
		(.08)	(.09)	(.01)	(.00)		(.08)	(.09)	(.01)	(.00)
Screens			7.35***	.24***	.04***			7.32***	.24***	.04***
			(.44)	(.02)	(.00)			(.44)	(.02)	(.00)
Movie FE	Y	N	N	N	N	Y	N	N	N	N
Monthly FE	N	Y	Y	Y	Y	N	Y	Y	Y	Y
N	59967	59967	59967	59967	59967	59967	59967	59967	59967	59967
Adj R^2	.58	.36				.58	.36			

Note: The same as in Table 4.

Table 7. Heterogeneity in Foreclosure Effects

Foreclosure Type:	Allocation		Selection	Allocation		Selection
Specification:	(1)	(2)	(3)	(4)	(5)	(6)
	Linear FE	Tobit	Probit	Linear FE	Tobit	Probit
Integ	4.32***	5.37***	.01	6.73***	7.83***	.25***
	(.86)	(1.00)	(.05)	(1.02)	(1.14)	(.06)
Integ*News	2.77***	2.38***	.15***	2.83***	2.39***	.11**
	(.26)	(.28)	(.04)	(.30)	(.32)	(.04)
Integ*News^2	−.17***	−.15***	−.01***	−.19***	−.17***	−.01*
	(.02)	(.02)	(.00)	(.02)	(.02)	(.00)
Integ*Peak				−5.20***	−4.90***	−.35***
				(.89)	(.99)	(.08)
News	3.66***	4.10***	.16***	5.58***	6.38***	.22***
	(.16)	(.17)	(.01)	(.22)	(.22)	(.01)
News^2	−.11***	−.14***	−.01***	−.22***	−.26***	−.01***
	(.01)	(.01)	(.00)	(.01)	(.01)	(.00)
Peak				−1.70***	−2.65***	−.17***
				(.25)	(.30)	(.02)
Screens		7.35***	.24***		7.37***	.23***
		(.44)	(.02)		(.44)	(.02)
Theater FE	Y	N	N	Y	N	N
Monthly FE	Y	Y	Y	N	N	N
N	59967	59967	59967	59967	59967	59967
Adj R^2	.36			.32		

Note: The same as in Table 4.

Table 8. Robustness: Quality Measure

Robustness:	*Standardization*			*Ex-post Quality*			*Dependent Variable: Ratio*	
Foreclosure Type:	Allocation		Selection	Allocation		Selection	Selection	
Specification:	(1) Linear FE	(2) Tobit	(3) Probit	(4) Linear FE	(5) Tobit	(6) Probit	(7) Linear FE	(8) Tobit
Integ	10.22***	10.38***	.21***	10.19***	10.34***	.22***	2.79***	2.88***
	(.90)	(.91)	(.06)	(.89)	(.90)	(.06)	(.26)	(.28)
News							.62***	.61***
							(.02)	(.02)
Zscore	6.43***	6.53***	.19***					
	(.26)	(.27)	(.02)					
ln(Audience)				18.19***	19.99***	.48***		
				(.60)	(.59)	(.02)		
Screens		7.35***	.24***		7.29***	.25***		
		(.44)	(.02)		(.44)	(.02)		
Theater FE	Y	N	N	Y	N	N	Y	N
N	59967	59967	59967	59967	59967	59967	59967	59967
Adj R^2	.36			.47			.37	

Note: 1. In specifications (1), (2), (4) and (5), the dependent variable is the number of screenings, and in specification (3) and (6), the dependent variable is a binary variable which equals 1 if a theater j exhibits a movie i. In specification (7) and (8), the dependent variable is the ratio of minutes allocated to a movie to the total minutes available for screening at a theater, multiplied with 100 for scaling. 2. All regressions include movie characteristics such as genre, dummy for distributors, rating, and running time are controlled. Monthly fixed effects are also included in all the specifications. 3. In specifications (2), (3), (5), (6) and (8), theater characteristics such as location, chain, and the number of screens are controlled. 4. The total number of observations is 59,967 and in the Tobit regression (specification (2) and (5)), 10,329 samples were left-censored. 5. * $p<0.05$; ** $p<0.01$; *** $p<0.001$. 6. Robust standard errors clustered by theater are reported in parentheses.

Table 9. Robustness: Subsample Analysis

Foreclosure Type:	Allocation			Selection	Allocation			Selection	-			
Subsample:	The top 100 movies				The bottom 100 movies				Theater operating for the whole sample period			
Specification:	(1) Linear FE	(2) Linear FE	(3) Tobit	(4) Probit	(5) Linear FE	(6) Linear FE	(7) Tobit	(8) Probit	(9)	(10)	(11)	(12)
Integ	10.23***	10.31***	10.22***	.14	7.11***	7.12***	8.88***	.26*	9.84***	9.84***	9.93***	.19**
	(.94)	(.93)	(.97)	(.09)	(.83)	(.83)	(1.06)	(.13)	(1.07)	(1.06)	(1.07)	(.07)
News		1.42***	1.79***	.09***		−.26	−.50*	.03		2.17***	2.18***	.08***
		(.13)	(.14)	(.02)		(.15)	(.20)	(.02)		(.10)	(.10)	(.01)
Screens			9.53***	.27***			5.64***	.27***			6.93***	.23***
			(.57)	(.03)			(.40)	(.02)			(.48)	(.02)
Movie FE	Y	N	N	N	Y	N	N	N	Y	N	N	N
Theater FE	Y	Y	N	N	Y	Y	N	NY	Y	N	N	
Monthly FE	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
N	20608	20608	20608	20608	19536	19536	19536	19536	46720	46720	46720	46720
Adj R^2	.50	.38			.39	.37			.59	.37		

Notes: 1. The dependent variable is the number of screenings. 2. Both yearly and monthly time fixed effects were used except for Column 4, 5, and 6. In 4, 5, and 6, only year fixed effect were used. 3. Robust standard erros are reported in parentheses, and clustered by theater 4. * p<0.05, ** p<0.01, *** p<0.001

graphs

Figure 1. Timeline of the Game

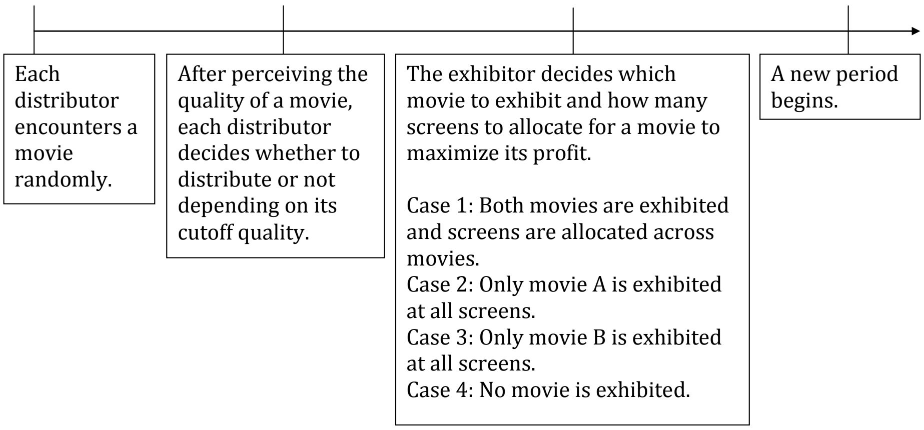
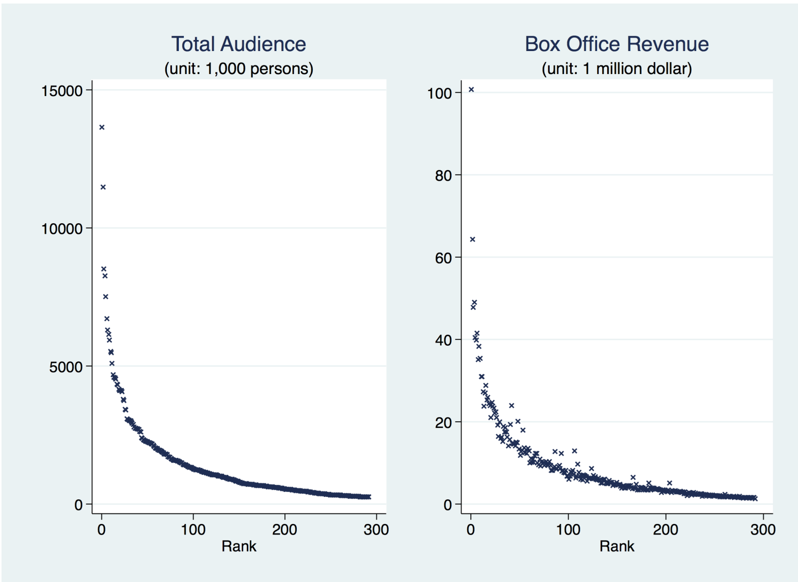
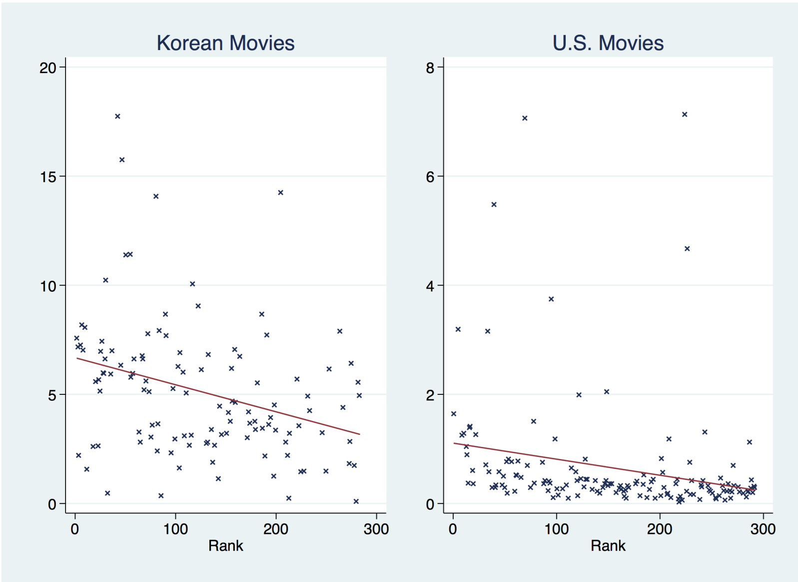


Figure 2. Audience Size and Revenue of the Top 300 Movies (2008–2010)



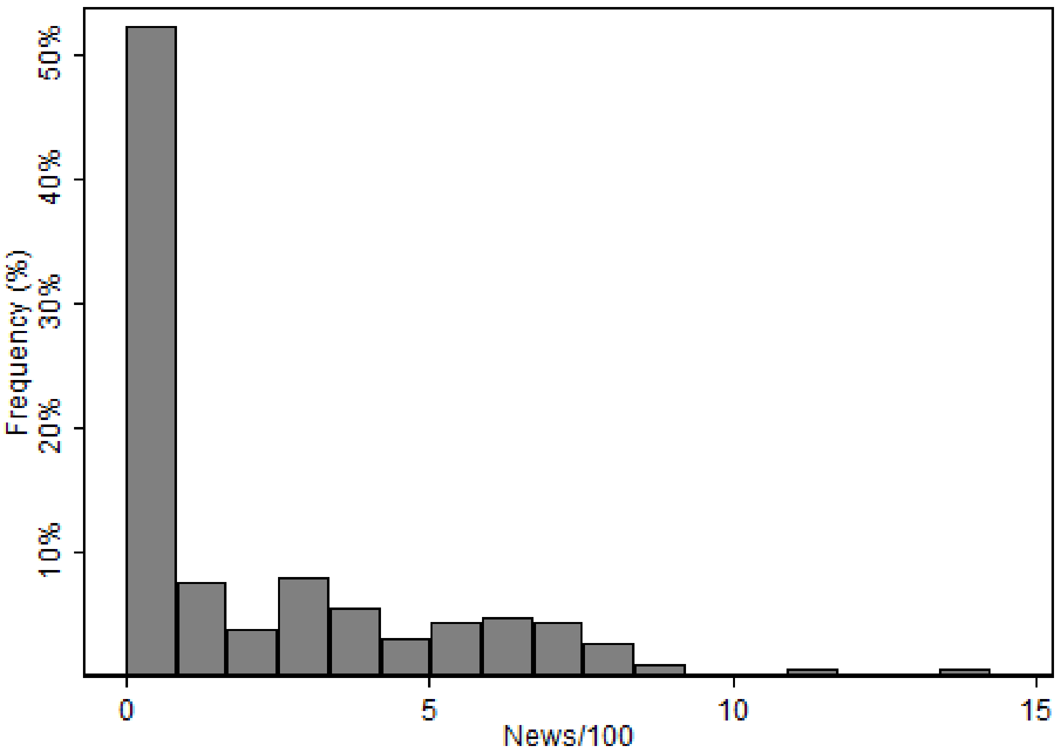
Note: The rank on the X axis is based on the number of audience.

Figure 3. Number of News Articles for the Top 300 Movies (2008–2010)



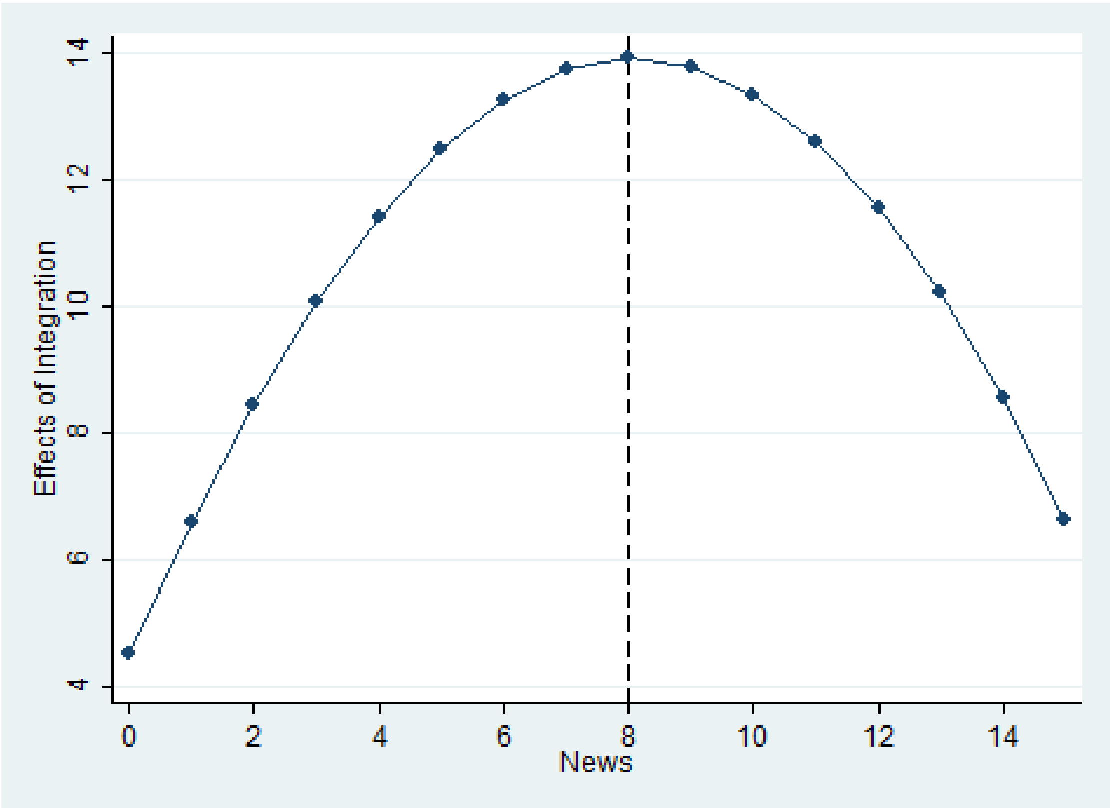
Notes: 1. The left graph shows the scatter plot of the number of news articles for Korea movies in the top 300 movies, while the right graph is for U.S. movies in the top 300 movies. The rank on the X axis is based on the number of audience. 2. The red line is the fitted regression line.

Figure 4. Histogram of *Ex-ante* Quality, News



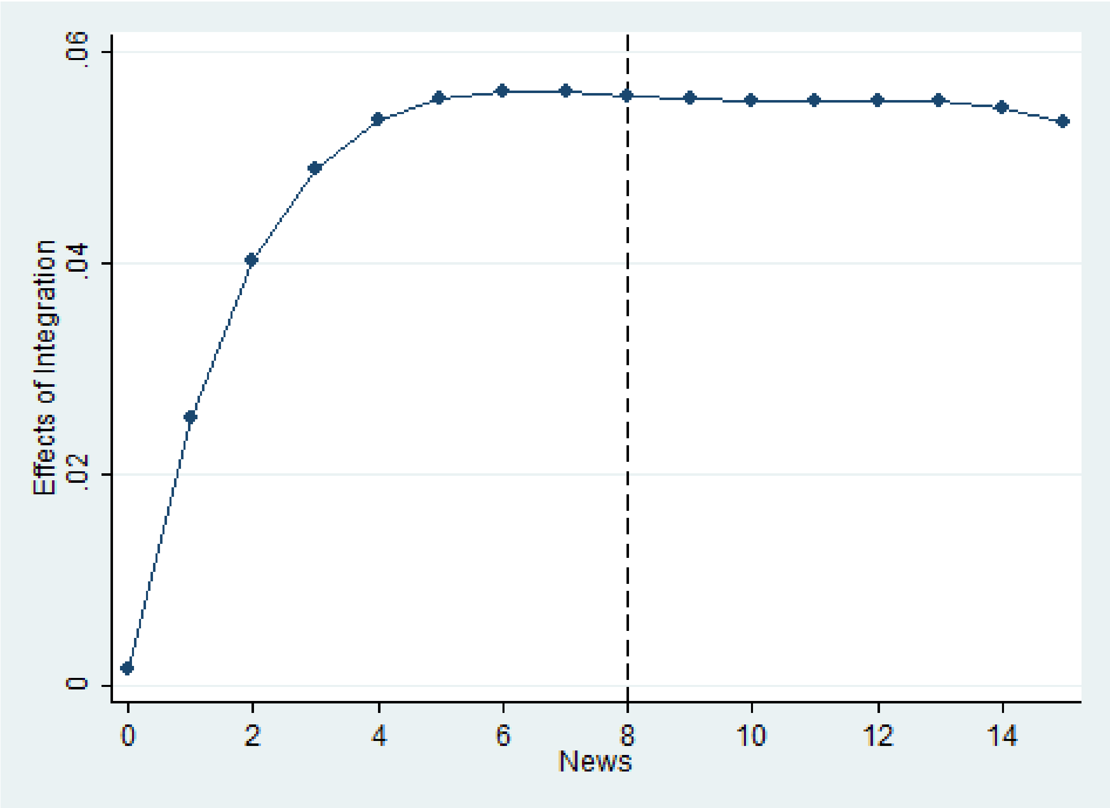
Note: The x-axis is the number of news articles (divided by 100) and the y-axis is the frequency (%) of movies

Figure 5. Allocation Foreclosure : Average Maringal Effects of Vertical Integration on Screening Times



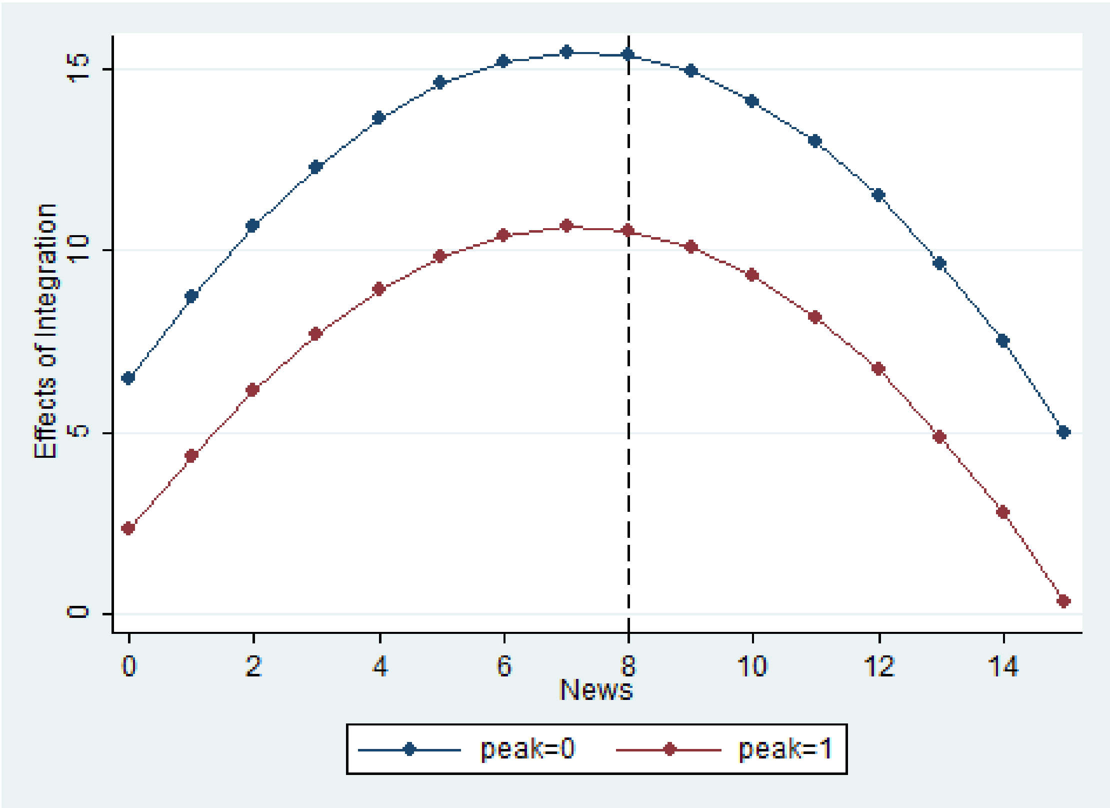
Notes: 1. The average marginal effects are calculated from the Tobit regression (Sepcification (3) in Table 4). 2. while the maximum number of news for a movie is 1771, 279 out of 292 movies (95.5% of movies) have the number of news below 800.

Figure 6. Selection Foreclosure : Average Maringal Effects of Vertical Integration on Contract



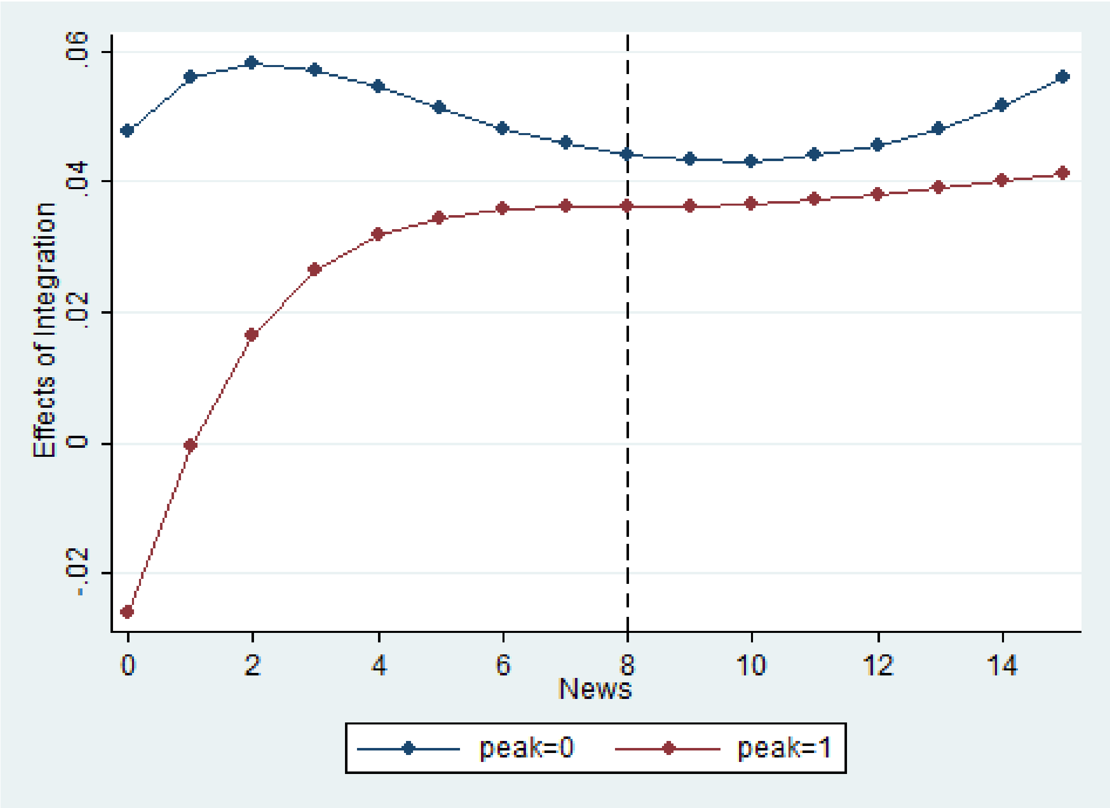
Notes: 1. The average marginal effects are calculated from the Probit regression (Sepcification (4) in Table 4). 2. while the maximum number of news for a movie is 1771, 279 out of 292 movies (95.5% of movies) have the number of news below 800.

Figure 7. Allocation Foreclosure : Average Maringal Effects of Vertical Integration on Screening Time (Peak)



Notes: 1. The average marginal effects are calculated from the Tobit regression (Sepcification (5) in Table 7). 2. while the maximum number of news for a movie is 1771, 279 out of 292 movies (95.5% of movies) have the number of news below 800.

Figure 8. Selection Foreclosure : Average Maringal Effects of Vertical Integration on Contract (Peak)



Notes: 1. The average marginal effects are calculated from the Probit regression (Sepcification (6) in Table 7). 2. while the maximum number of news for a movie is 1771, 279 out of 292 movies (95.5% of movies) have the number of news below 800.

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Appendix I: Mathematical Proof

We seek the equilibrium at which both distributors decide whether to distribute using the cutoff strategies. Distributor i's strategy can be expressed as follows:

$$\mathcal{K}_i := \{Q_i \in \mathcal{D} | \text{ Distributor } i \text{ does not distribute}\} = \{Q_i \in \mathcal{D} | Q_i < \hat{Q}_i\}$$

for the cutoff quality $\hat{Q}_i \in \mathcal{D}$.

We also mathematically define the sets in Equation ((2)) as follows:

$$\begin{aligned} \mathcal{S}^{ij}(Q_j) &: \{Q_i | R^1 = max[R^1, R^2, R^3] \text{ given } Q_j\} \\ \mathcal{S}^{i0}(Q_j) &: \{Q_i | R^2 = max[R^1, R^2, R^3] \text{ given } Q_j\} \\ \mathcal{S}^{0j}(Q_j) &: \{Q_i | R^3 = max[R^1, R^2, R^3] \text{ given } Q_j\}. \end{aligned}$$

Proof of Lemma 1 (i) $(\hat{N}_A, \hat{N}_B)$[49] has to satisfy the first-order condition, that is,

$$R_N(N_A; Q_A) = \beta_B R_N(N_B; Q_B).$$

Since $\beta_B < 1$, the strict concavity of $R(N_i; Q_i)$ in N_i implies that $\hat{N}_A > \hat{N}_B$.

(ii) Given the rival movie's quality $\bar{Q}$, $\mathbb{P}[\mathcal{S}^{AB}(\bar{Q}) \cup \mathcal{S}^{A0}(\bar{Q})] \geq \mathbb{P}[\mathcal{S}^{BA}(\bar{Q}) \cup \mathcal{S}^{B0}(\bar{Q})]$ means $\mathbb{P}[\mathcal{S}^{0B}(\bar{Q})^c] \geq \mathbb{P}[\mathcal{S}^{0A}(\bar{Q})^c]$. Therefore, to prove Lemma 1(ii), it suffices to show either $\mathcal{S}^{0A}(\bar{Q})^c \subset \mathcal{S}^{0B}(\bar{Q})^c$ or $\mathcal{S}^{0B}(\bar{Q}) \subset \mathcal{S}^{0A}(\bar{Q})$, because $F(Q_i)$ is *i.i.d.* In the following, we take the latter approach.

Note that

$$\begin{aligned} \mathcal{S}^{0B}(\bar{Q}) := &\underbrace{\{Q_A | \beta_B R(\bar{N}; \bar{Q}) \geq R(\bar{N}; Q_A)\}}_{\textbf{(A)}} \\ &\cap \underbrace{\{Q_A | \beta_B R(\bar{N}; \bar{Q}) > R(\hat{N}_A(Q_A, \bar{Q}); Q_A) + \beta_B R(\hat{N}_B(Q_A, \bar{Q}); \bar{Q}) - C\}}_{\textbf{(B)}} \end{aligned}$$

[49] For notational convenience, we replace $\hat{N}_i$ for $\hat{N}_i(Q_A, Q_B)$ from now on.

and

$$\mathcal{S}^{0A}(\bar{Q}) := \underbrace{\{Q_B | R(\bar{N};\bar{Q}) \geq \beta_B R(\bar{N};Q_B)\}}_{\textbf{(A}'\textbf{)}}$$
$$\cap \underbrace{\{Q_B | R(\bar{N};\bar{Q}) > R(\hat{N}_A(\bar{Q},Q_B);\bar{Q}) + \beta_B R(\hat{N}_B(\bar{Q},Q_B);Q_B) - C\}}_{\textbf{(B}'\textbf{)}}.$$

Our proof is complete if we show (1) that an arbitrary $\dot{Q}$ that is the member of **(A)** also belongs to **(A′)** and (2) that an arbitrary $\dot{Q}$ that is the member of **(B)** also belongs to **(B′)**.

First, since $R(N_i)$ is strictly increasing in Q_i and $\beta_B < 1$, an arbitrary $\dot{Q}$ that satisfies $R(\bar{N};\bar{Q}) \geq R(\bar{N};\dot{Q})/\beta_B$ in **(A)** also satisfies $R(\bar{N};\bar{Q}) \geq \beta_B R(\bar{N};\dot{Q})$ in **(A′)**. Therefore, for any $\dot{Q} \in$ **(A)**, $\dot{Q} \in$ **(A′)**.

Next, to show if $\dot{Q} \in$ **(B)**, then $\dot{Q} \in$ **(B′)**, let us rewrite **(B)** and **(B′)** like the following:

$$\textbf{(B)} = \{Q_A | C \geq R(\hat{N}_A(Q_A,\bar{Q});Q_A) + \beta_B R(\hat{N}_B(Q_A,\bar{Q});\bar{Q}) - \beta_B R(\bar{N};\bar{Q})\} \qquad \text{(A.1)}$$

and

$$\textbf{(B}'\textbf{)} = \{Q_B | C \geq R(\hat{N}_A(\bar{Q},Q_B);\bar{Q}) + \beta_B R(\hat{N}_B(\bar{Q},Q_B);Q_B) - R(\bar{N};\bar{Q})\}. \qquad \text{(A.2)}$$

We show that for an arbitrary $\dot{Q}$ the RHS in (A.1) is larger than the RHS in (A.2). Then, an arbitrary $\dot{Q}$ that belongs to **(B)** also belongs to **(B′)**. The difference between the RHSs in (A.1) and (A.2) is as follows:

$$\begin{aligned}
\text{Diff} :&= (\hat{N}_A(\dot{Q},\bar{Q});\dot{Q}) + \beta_B R(\hat{N}_B(\dot{Q},\bar{Q});\bar{Q}) - \beta_B R(\bar{N};\bar{Q}) \\
&\qquad - [R(\hat{N}_A(\bar{Q},\dot{Q});\bar{Q}) - \beta_B R(\hat{N}_B(\bar{Q},\dot{Q});\dot{Q}) - R(\bar{N};\bar{Q})] \\
&= (1-\beta_B) R(\bar{N};\bar{Q}) + [R(\hat{N}_A(\dot{Q},\bar{Q});\dot{Q}) + \beta_B R(\hat{N}_B(\dot{Q},\bar{Q});\bar{Q})] \\
&\qquad - [R(\hat{N}_A(\bar{Q},\dot{Q});\bar{Q}) + \beta_B R(\hat{N}_B(\bar{Q},\dot{Q});\dot{Q})]
\end{aligned}$$

If we differentiate the difference with respect to β_B,

$$\begin{aligned}\frac{\partial \text{Diff}}{\partial \beta_B} &= -R(\bar{N};\bar{Q}) + [R_N(\hat{N}_A(\dot{Q},\bar{Q});\dot{Q}) - \beta_B R_N(\hat{N}_B(\dot{Q},\bar{Q});\bar{Q})]\frac{\partial \hat{N}_A}{\partial \beta_B} + R(\hat{N}_B(\dot{Q},\bar{Q});\bar{Q}) \\ &\quad - [R_N(\hat{N}_A(\bar{Q},\dot{Q});\bar{Q}) - \beta_B R_N(\hat{N}_B(\bar{Q},\dot{Q});\dot{Q})]\frac{\partial \hat{N}_A}{\partial \beta_B} - R(\hat{N}_B(\bar{Q},\dot{Q});\dot{Q}) \\ &= -R(\bar{N};\bar{Q}) + R(\hat{N}_B(\dot{Q},\bar{Q});\bar{Q}) - R(\hat{N}_B(\bar{Q},\dot{Q});\dot{Q}) < 0\end{aligned} \tag{A.3}$$

The square brackets on the first and second lines are zero according to the first-order condition of the exhibitor's profit maximization problem (the envelope theorem). In addition, note that since $\bar{N} > \hat{N}_B(\dot{Q},\bar{Q})$ and thus $R(\bar{N};\bar{Q}) > R(\hat{N}_B(\dot{Q},\bar{Q});\bar{Q})$, the last line of (A.3) is less than zero. On the contrary, if $\beta_B = 1$, there is no distortion in the optimal allocation of the exhibitor based on the vertical relationship and hence the difference (*Diff*) is zero.

Therefore, as β_B increases, the difference becomes smaller. When $\beta_B = 1$, the difference is zero, which is the minimum. Since the difference is always larger than or equal to zero, $\dot{Q} \in$ **(B′)** for any $\dot{Q} \in$ **(B)**. □

To prove Proposition 1, we need the following lemma.

Lemma A.1. *Under Assumptions 1 and 2,*

(i) $\mathcal{S}^{i0}(Q_j)$ *is decreasing in the rival movie's quality,* Q_j *such that for* $Q_j < \dot{Q}_j$, $\mathcal{S}^{i0}(\dot{Q}_j) \subset \mathcal{S}^{i0}(Q_j)$, *and* $\mathcal{S}^{0j}(Q_j)$ *is increasing in the rival movie's quality,* Q_j *such that for* $Q_j < \dot{Q}_j$ $\mathcal{S}^{0j}(Q_j) \subset \mathcal{S}^{0j}(\dot{Q}_j)$ *for* $i,j = \{A.B\}$;

(ii) $\mathbb{E}[\pi_{D_i}|Q_i]$ *is strictly increasing in its own quality,* Q_i, *and is increasing in the rival's cutoff quality,* $\hat{Q}_j$.

Proof of Lemma A.1 (i) Without loss of generality, we take $i = A$. First, we show that $\mathcal{S}^{i0}(Q_j)$ is decreasing in the rival movie's quality, Q_j:

$$\mathcal{S}^{A0}(Q_B) := \{Q_A | R^2 = \max[R^1, R^2, R^3]\}$$
$$= \underbrace{\{Q_A | R(\bar{N};Q_A) \geq \beta_B R(\bar{N};Q_B)\}}_{\textbf{(A)}} \cap \underbrace{\{Q_A | R(\bar{N};Q_A) \geq R(\hat{N}_A;Q_A) + \beta_B R(\hat{N}_B;Q_B) - C\}}_{\textbf{(B)}}$$

For this, we need to show that both **(A)** and **(B)** are decreasing in Q_B. In **(A)**, the RHS of the inequality is strictly increasing in Q_B from Assumption 1(iii). This means that as Q_B increases, Q_A has to increase to satisfy the inequality, which in turn implies that **(A)** is decreasing in Q_B.

Now, we show that **(B)** is decreasing in Q_B. **(B)** can be rewritten as

$$\{Q_A | R(\bar{N}; Q_A) - [R(\hat{N}_A; Q_A) + \beta_B R(\hat{N}_B; Q_B)] \geq C\}. \tag{A.4}$$

The LHS of the inequality in (A.4) is strictly decreasing in Q_B as $R(\hat{N}_A; Q_A) + \beta_B R(\hat{N}_B; Q_B)$ increases. Now, we check how the LHS changes in response to Q_A. If we differentiate the LHS with respect to Q_A,

$$\begin{aligned} &R_Q(\bar{N}; Q_A) - R_Q(\hat{N}_A; Q_A) - [R_N(\hat{N}_A; Q_A) - \beta_B R_N(\hat{N}_B; Q_B)] \frac{\partial \hat{N}_A}{\partial Q_A} \\ &= R_Q(\bar{N}_A; Q_A) - R_Q(\hat{N}_A; Q_A) > 0. \end{aligned} \tag{A.5}$$

The third term on the first line of (A.5) is zero according to the exhibitor's first-order condition: $R_N(\hat{N}_A; Q_A) - \beta_B R_N(\hat{N}_B; Q_B) = 0$ for all (Q_A, Q_B). The inequality on the second line holds as $R_Q(\cdot : Q_i)$ is strictly increasing in N_i under Assumption 1(iv): $\frac{\partial^2 R(\cdot;\cdot)}{\partial Q_i \partial N_i} > 0$. Therefore, we find that as Q_B increases, Q_A needs to increase to satisfy the inequality in (A.4). In other words, a higher quality level for movie A is required in response to a higher quality of movie B. Therefore, set **(B)** shrinks. As both **(A)** and **(B)** are decreasing in Q_B, $\mathcal{S}^{i0}(Q_j)$ is decreasing in the rival movie's quality, Q_j.

Now, we show that $\mathcal{S}^{0j}(Q_j)$ is increasing in Q_j. $\mathcal{S}^{0B}(Q_B)$ can be similarly expressed as follows:

$$\begin{aligned} \mathcal{S}^{0B}(Q_B) :&= \{Q_A | R^3 = \max[R^1, R^2, R^3]\} \\ &= \underbrace{\{Q_A | \beta_B R(\bar{N}; Q_B) \geq R(\bar{N}; Q_A)\}}_{\textbf{(A)}} \\ &\qquad \cap \underbrace{\{Q_A | \beta_B R(\bar{N}; Q_B) \geq R(\hat{N}_A; Q_A) + \beta_B R(\hat{N}_B; Q_B) - C\}}_{\textbf{(B)}} \end{aligned}$$

We need to show that both **(A)** and **(B)** are strictly increasing in Q_B. According to Assumption 1(iii), as Q_B increases, the LHS of the inequality in **(A)** increases. Then, a higher level of Q_A than before can satisfy the inequality, which means that **(A)** is increasing in Q_B.

Now, we show that **(B)** is increasing in Q_B. **(B)** can be rewritten as

$$\{Q_A | \beta_B R(\bar{N}; Q_B) - [R(\hat{N}_A; Q_A) + \beta_B R(\hat{N}_B; Q_B)] \geq C\}. \tag{A.6}$$

The LHS of inequality (A.6) is strictly decreasing in Q_A as $R(\hat{N}_A; Q_A) + \beta_B R(\hat{N}_B; Q_B)$ increases. To check how the LHS changes in response to Q_B, we differentiate the LHS with respect to Q_B:

$$\begin{aligned} &\beta_B[R_Q(\bar{N}; Q_B) - R_Q(\hat{N}; Q_B)] - [R_N(\hat{N}_A; Q_A) - \beta_B R_N(\hat{N}_B; Q_B)] \frac{\partial \hat{N}_A}{\partial Q_A} \\ &= \beta_B[R_Q(\bar{N}; Q_B) - R_Q(\hat{N}; Q_B)] > 0. \end{aligned} \tag{A.7}$$

The third term on the first line of (A.7) is zero from the exhibitor's first-order condition. The inequality on the second line holds as $R_Q(\cdot; Q_i)$ is strictly increasing in N_i under Assumption 1(iv). Therefore, we find that as Q_B increases, a higher level of Q_A than before can satisfy inequality (A.6). Hence, for a higher level of Q_B, set **(B)** expands. As both **(A)** and **(B)** are increasing in Q_B, $\mathcal{S}^{0j}(Q_j)$ is increasing in the rival movie's quality, Q_j.

(ii) Given the cutoff quality, $\hat{Q}_B \in \mathcal{D}$, the conditional expectation of distributor A's profit can be expressed as follows:

$$\begin{aligned} \mathbb{E}[\pi_{D_A}|Q_A] = &\underbrace{\int_{\mathcal{K}_B} R(\bar{N}; Q_A) dF}_{\textbf{(A)}} + \underbrace{\int_{\mathcal{K}_B^c \cap \mathcal{S}^{BA}(Q_A)} R(\hat{N}_A; Q_A) dF}_{\textbf{(B)}} \\ &+ \underbrace{\int_{\mathcal{K}_B^c \cap \mathcal{S}^{0A}(Q_A)} R(\bar{N}; Q_A) dF}_{\textbf{(C)}} + \underbrace{\int_{\mathcal{K}_B^c \cap \mathcal{S}^{B0}(Q_A)} 0 dF}_{\textbf{(D)}}. \end{aligned} \tag{A.8}$$

In **(A)**, all screens are allocated to movie A, as movie B is not distributed, i.e., $Q_B \in K_B$. In **(B)**, both movies are distributed and screened according to the exhibitor's optimality condition. In **(C)**, all screens are allocated to movie A, even though movie B was distributed. In **(D)**, the exhibitor shows movie B only.

All the integrands are strictly increasing in Q_A. From Lemma A.1(i), as Q_A increases, $\mathcal{K}_B^c \cap \mathcal{S}^{B0}(Q_A)$ decreases. The decreased part of $\mathcal{K}_B^c \cap \mathcal{S}^{B0}(Q_A)$, where A obtains the minimum revenue, will move to either $\mathcal{K}_B^c \cap \mathcal{S}^{0A}(Q_A)$ or $\mathcal{K}_B^c \cap \mathcal{S}^{BA}(Q_A)$. Similarly, as Q_A increases, $\mathcal{K}_B^c \cap \mathcal{S}^{0A}(Q_A)$ increases. The increased part of $\mathcal{K}_B^c \cap \mathcal{S}^{0A}(Q_A)$, where A obtains the maximum revenue, comes from either $\mathcal{K}_B^c \cap \mathcal{S}^{B0}(Q_A)$ or $\mathcal{K}_B^c \cap \mathcal{S}^{BA}(Q_A)$. However, note that $R(\bar{N}; Q_A) > R(\hat{N}_A; Q_A) > 0$. Therefore, the expected profit of distributor A is increasing in Q_A.

Furthermore, it is trivial that $\mathbb{E}[\pi_{D_A}|Q_A]$ is decreasing in $\hat{Q}_B$ from the definition of $\mathcal{K}_B$. Distributor B's case can be proven similarly. □

Proof of Proposition 1 (ii) First, we start with Proposition 1(ii). The conditional expectation of distributor A is expressed in (A.8). The conditional expectation of distributor B is also expressed in a similar way, but with the revenue share of $\beta_B (< 1)$. Hence, Proposition 1(ii) holds from $\beta_B < 1$ and Lemma 1(i, ii).

(i) Owing to the existence and uniqueness of the cutoff strategy equilibrium in Proposition 1(i), consider the following two equations:

$$\mathbb{E}[\pi_{D_A}|\hat{Q}_A] - F_D \tag{A.9}$$

$$\mathbb{E}[\pi_{D_B}|\hat{Q}_B] - F_D. \tag{A.10}$$

Since we assume that the two distributors are *risk-neutral*, they distribute only if $\mathbb{E}[\pi_{D_i}|\hat{Q}_i] \geq F_D$, where $\hat{Q}_i$ is defined in Equation (3). Define $\hat{Q}_i$ as distributor i's cutoff strategy in which i distributes only if $Q_i \geq \hat{Q}_i$. From the definition of cutoff quality and Assumption 2, there exists distributor i's corresponding cutoff quality for any rival's strategy, $\hat{Q}_j$. According to Lemma A.1(ii), $\mathbb{E}[\pi_i|Q_i] - F_D$ is strictly increasing in Q_i and increasing in $\hat{Q}_j$. Therefore, as $\bar{Q}_j$ increases, $\hat{Q}_i$ has to decrease.

Define $\hat{Q}_i^0 = \inf\{Q_i \in \mathcal{D} \mid \mathbb{E}[\pi_i|Q_i] \geq F_{D_i}$ and $\hat{Q}_j = 0\}$ and $\hat{Q}_i^\infty = \inf\{Q_i \in \mathcal{D}|\hat{Q}_j = \infty\}$.[50][51] Naturally, $\hat{Q}_i^\infty > \hat{Q}_i^0$. Further, Proposition 1(ii) implies $\hat{Q}_B^0 \geq Q_A^0$ and $\hat{Q}_B^\infty \geq Q_A^\infty$. On the $(\hat{Q}_A, \hat{Q}_B)$ space, two decreasing lines represent $\hat{Q}_i$ for the given $\hat{Q}_j$. One end of each line will be $\hat{Q}_i^0$ and they asymptotically converge to $\hat{Q}_i^\infty$ as $\bar{Q}_j \to \infty$. The monotonicity, Assumption 2 and the fact that ensure the existence and uniqueness of the equilibrium when cutoff strategies are used.

(iii) This follows from Proposition 1(ii).

(iv) The probability of movie i being distributed is $\int_{\hat{Q}_i^*}^\infty dF(Q_i)$. Thus, since $\hat{Q}_A^* < \hat{Q}_B^*$, $\int_{\hat{Q}_B^*}^\infty dF(Q_B) < \int_{\hat{Q}_A^*}^\infty dF(Q_A)$ and thus the expected number of distributor A's movie exhibited at theaters will be higher. □

[50] $\hat{Q}_j \to \infty$ implies that distributor j always chooses not to distribute regardless of its quality. In this case, $\lim_{\hat{Q}_j \to \infty} \mathcal{K}_B^c = \emptyset$ and thus $\lim_{\hat{Q}_j \to \infty} \mathbb{E}[\pi_{D_i}|Q_i] = \int_{\mathcal{K}_B} \beta_i R(\bar{N}; Q_i)$, which is equivalent to the revenue obtained in the setting in which distributor i is the monopolistic firm in the distribution market.

[51] Also note that under certain value of F, both $\hat{Q}_i^0$ and $\hat{Q}_i^\infty$ can be finite.

Appendix II: Details of the Korean Movie Industry

According to the Motion Picture Association of America (MPAA), Korea ranks seventh with 1.6 billion U.S. dollars of box office revenue (MPAA, 2014). In 2014, Korea's attendance crossed the 200 million mark for the second year in a row and admission per capita was 4.19, one of the world's top per capita attendances along with Iceland and Singapore (Korean Film Council, 2014).

Production Stage

The production side in Korea consists of numerous small and competitive firms. Korean production studios have very low budgets. The average production costs of Korean movies were around 2 million dollars in 2014, while that of U.S. movies by major studios was around 100 million dollars in 2007.[52] Even after excluding low budget movies under one million dollars, which covers 72.3% of Korean movies, average production costs were only around 5.9 million dollars.[53] Korean production studios have very low budgets compared with U.S. studios. In addition, many of these small Korean production companies are under the influence of large distribution conglomerates since many movies, especially Korean blockbusters, receive direct or indirect investment from the movie divisions of conglomerates including the *CJ Group*, the *Orion Group*, and the *Lotte Group*. These large conglomerates, called *Chaebol*, are particularly influential because they are vertically integrated in the distribution and exhibition stages in Korea. Therefore, we consider the distribution and production sides to be a single entity in our model and focus only on the relationship between distribution and exhibition.

Distribution Stage

The distribution market is oligopolistic in Korea. In the distribution market, the attendance market share of the top five distributors was around 70% from 2008 to 2014. *CJ Entertainment and Media (CJ E&M)* of the conglomerate *CJ Group* ranked first in attendance market share for those years. In most years, a few Korean production firms

[52] For instance, *The Lord of the Rings: The Return of the King* (2003) cost just over 100 million dollars and *Jurassic Park* was on the lower end of the average movie budget (1993), costing 63 million dollars. (http://www.investopedia.com/financial-edge/0611/why-movies-cost-so-much-to-make.aspx.) On the contrary, *Snowpiercer*, the most expensive Korean movie up to 2015, cost only 39.2 million dollars. (http://www.imdb.com/title/tt1706620.)

[53] The total production cost includes marketing costs as well as movie production costs. In 2005, movie production costs accounted for 68.4% of total production costs. In 2014, the total production costs of Korean movies that hit theaters reached around 436.2 billion Korean won (414.1 million dollars) and net movie production costs accounted for 74.1% of total production costs.

have been dominant players. These include *Lotte Entertainment* of the *Lotte Group*, *Showbox* of the *Orion Group*, and *Next Entertainment World* as well as subsidiaries of Hollywood studios such as *Warner Brothers*, *20th Century Fox*, *Universal Pictures International (UPI)*, and *Sony Pictures*.

Exhibition Stage and Degree of Vertical Integration

In the exhibition market, there are three major multiplex chains: *CGV* of the *CJ Group*, *Lotte Cinema* of the *Lotte Group*, and *Megabox*, once owned by the *Orion Group*. In 2014, these three multiplex chains owned 295 theaters and 2,164 screens, covering 82.8% of all 356 theaters and 94.8% of all 2,281 screens in Korea. In addition, they served more than 96.9% of the total audience.

Major distribution and exhibition companies are vertically integrated under the parent conglomerate. The *CJ Group* has a distribution company, *CJ E&M*, and an exhibition company, *CGV*. Likewise, *Lotte Group* has *Lotte Entertainment* and *Lotte Cinema*. In addition, the *Orion Group* once had *Showbox* and *Megabox* until it sold the latter in 2007.

The number of Korean and foreign movies that hit theaters has also been increasing. According to the annual report of the KOFIC, while foreign movies account for around 65–80% in terms of the number of movie releases, Korean movies account for around 50% in terms of attendance (KOFIC, 2014). The Korean market is one of the few in which domestic movies can compete with Hollywood movies (Hwang, 2013). Along with the popularity and success of Korean movies, their production has increased dramatically. From 2008 to 2014, Korean movies at theaters increased by more than eight times, while foreign movies increased by around 3.8 times. In 2014, 217 of the 248 Korean movies produced (87.5%) and 878 of the 1,036 foreign movies imported (84.7%) hit theaters.