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# Avoiding Head-to-Head Competition on the Big Screen: The Economics of Movie Distribution*

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**Abstract**

This paper provides theoretical explanations for devices that movie distributors use to avoid head-to-head competition. We use a simple static model to show how revenue sharing exhibition contracts provide multiplex owners with incentives to take cross effects on demand into account. Then we simulate a dynamic version of the model to explain the practice of staggering the release dates of hit movies and consider how vertical integration affects release patterns and the allocation of movies to screens. The dynamic model is of independent interest because it allows for dynamic strategic interaction in a common agency framework.

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**Keywords:** common agency, exclusive dealing, entertainment, film, licensing

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# 1. Introduction

The management of vertical relationships is one of the fundamental issues addressed by contract and organization theorists. How should suppliers design contracts with retailers? What are the consequences if suppliers forward integrate into retailing? The answers to these questions inform management strategy and public policy. This paper provides insight into vertical relationships by analyzing relationships between movie distributors (studios or independent distributors) and exhibitors (theaters). We focus on distribution strategies that help distributors avoid head-to-head competition (competition with products that steal demand from each other). Focusing on the movie business allows us to structure our analysis of vertical relationships using features of the real-world environment.

Suppliers in most industries prefer to avoid head-to-head competition, but for movie distributors it is particularly important to do so. Compared to most products, movies are produced relatively infrequently and involve large upfront expenditures and high risk.[1] Thus, it is important to design exhibition contracts and manage release dates to ensure the highest possible chance of success for each movie. The movie business is an interesting example for another reason: in modern times, given the presence of multiplexes (theaters with multiple auditoriums), exclusive dealing is impractical. No distributor distributes enough movies to continually satisfy the demand of a large multiplex owner. This implies that distributors must design contracts and manage distribution knowing that all distributors deal with the same exhibitors.

Our goal in this paper is to provide a basis in theory for some of the devices movie distributors use to avoid head-to-head competition. One device is the exhibition contract, which typically bases the exhibitor's payment on ticket revenue. In Section 2 we introduce a simple static model in which two distributors compete to place their movies in a multiplex. We use the model to show that revenue sharing contracts provide incentives for exhibitors to consider cross effects on the demand for movies.[2] Revenue sharing makes it less likely that

[1] The Motion Picture Association of America reports that in 1998 a total of 490 new movies were released in the United States and the average production, advertising, and promotion costs were $78 million. Vogel (1998) reports that most movies do not earn a positive return on investment.

[2] Other authors provide complementary explanations for various features of movie exhibition contracts. De Vany and Eckert (1991) and De Vany and Walls (1996) emphasize that difficulties with forecasting demand

movies that steal demand from each other will be shown simultaneously.

In Subsection 2.1 we compute a dynamic version of the model of the multiplex to examine the practice of avoiding simultaneous new hit releases. The results characterize the conditions under which delaying the release of a movie that is anticipated to be a hit increases a distributor's expected value. In Subsection 2.2 we consider how vertical integration affects releases and run lengths.[3] In our model, vertical integration leads to less head-to-head competition, but more turnover in distributor inventories.

Most of the literature that investigates how suppliers avoid head-to-head competition ignores vertical relationships and focuses on how manufacturers choose product characteristics. In contrast, in our model the process that generates product characteristics is exogenous - we focus on distribution strategies. In the literature that discusses vertical relationships, most of the emphasis is on exclusive dealing. Recent papers along this line include Martimort (1996) and Bernheim and Whinston (1998). In other literature that addresses issues similar to those addressed here, Aghion and Bolton (1987) analyze how an incumbent seller facing a threat of entry can sign a long-term contract with a buyer to attempt to deter entry, and O'Brien and Shaffer (1997) and Kahn and Mookherjee (1998) analyze how multiple principals can use non-exclusive contracts to provide incentives to a common agent. We contribute to the literature by combining contract choice with other strategic choices and considering dynamic competition that allows for richer strategic interaction.

Although our dynamic model is designed to explain vertical relationships in the movie business, many of the insights apply to other goods, particulary new entertainment goods with uncertain demand such as books and compact disks. Further, the model could be adapted to provide insight into other types of contractual and organizational arrangements,

necessitate the use of short-term contingency-rich contracts. Filson et al. (2000) show that revenue sharing allows distributors to share risk with exhibitors. Kenney and Klein (1983) and Hanssen (2000) analyze block booking, the practice of contracting on multiple movies at once, which was banned by the *Paramount* decrees of the late 1940s and early 1950s. Borcherding and Filson (2001) review the literature on contracts in the movie business.

[3] Vertical integration in the movie industry is particularly interesting because of the *Paramount* decrees, which barred studios from owning theaters and from using integrative contracts like block booking, the practice of contracting on an entire season of movies at once. In the 1980s the U.S. Department of Justice gave studios permission to forward integrate into exhibition again (De Vany and Eckert, 1991, Mansfeild, 1997). Some distributors have done so, including Sony, which bought the Loew's theatre chain. Although we do not attempt a normative analysis, our results could inform such an analysis.

including non-vertical ones. The model is similar to a dynamic multiple-principal single-agent model. Static multiple-principal single-agent models have been analyzed by Bernheim and Whinston (1986) and many others but as far as we are aware there is no dynamic version of the model in the literature. Although there is no asymmetric information in our model, the structure may be useful for analyzing some dynamic environments in which two decision-makers attempt to influence a third party.

## 2. The Multiplex

The multiplex provides the simplest environment for examining devices that distributors use to avoid head-to-head competition because the analysis can focus on a single exhibitor, the multiplex owner. In a multiplex the exhibitor chooses multiple movies, so cross effects on demand can be examined. For example, the demand for Horror A is likely to be higher if it is paired with a drama instead of another horror movie. Leaving genre aside, distributors may wish to avoid placing two hit movies in the theater at the same time because many consumers have time for only one movie and will be forced to choose. In a world with zero transactions costs and no regulations, each distributor would like to negotiate a contract with the exhibitor that specifies the exhibitor's *entire slate of movies* to force the exhibitor to consider cross effects on demand.

This section introduces a model of movie allocation in a multiplex and considers contracts that specify the exhibitor's entire slate of movies. The results show that the equilibrium allocations with such contracts can be implemented with simple contracts that base the exhibitor's payment on ticket revenue.[4] The basic model and the results are similar to Bernheim and Whinston (1985, 1998). In our analysis we ignore costs and assume that profit

[4] De Vany and Eckert (1991) and Filson et al. (2000) note that revenue sharing evolved prior to multiplexes becoming wide-spread. Therefore, the incentive effect we describe here is not necessary in order to observe revenue sharing. However, the incentive effect is present. We do not explore the reasons for constructing multiplexes, but there are several reasons for doing so. Multiplexes are in a better position to absorb idiosyncratic demand shocks because negative shocks on one movie can be balanced against positive shocks on others. Reallocation of movies to auditoriums of different sizes can occur as demand is observed. Scale economies in running the box office and the concession are also important: showing times can be staggered to keep staff and other inputs continuously employed. In any case, multiplexes are now pervasive. The National Association of Theatre Owners reports that in the U.S. in 1997 there were 31,865 movie screens, but only 7,480 theaters and 537 exhibition companies.

maximization is equivalent to revenue maximization. This is a reasonable approximation to reality because when a movie is placed in the theater most of the distributor's costs are sunk and most of the exhibitor's costs are fixed costs.

The model has two distributors and one exhibitor. Each distributor has two movies: Distributor 1 has 1a and 1b and Distributor 2 has 2a and 2b. The exhibitor has a single theater with two auditoriums, so it can show only two of the four movies. For simplicity, assume that both auditoriums are identical. There is no private information, so every player has the same expectations about demand. All players are risk neutral. Risk neutrality may be unrealistic (see Filson et al. 2000), but it simplifies the analysis of the contracting problem and allows us to focus on how distributors respond to cross-demand effects. For simplicity we ignore concession revenue.[5]

The game proceeds as follows: Each distributor submits a list of six bids, one for every possible allocation of movies to auditoriums ({1a,2a}, {1a,1b}, {1a,2b}, {2a,1b}, {2a,2b}, and {1b,2b}). For example, Distributor 1 submits bid $b^1_{1a2a}$ for the allocation {1a, 2a}, $b^1_{1a1b}$ for the allocation {1a, 1b}, and so on. Then the exhibitor chooses the combination of movies that maximizes the total bid. We compute subgame perfect Nash equilibria, and following Bernheim and Whinston (1998) we focus on equilibria that are Pareto-undominated (within the set of equilibria) for the distributors.

Denote the expected revenue (the gross) of movie $i$ when it is paired with movie $j$ by $g^i_{ij}$. For example, when 1a is paired with 2a its expected revenue is $g^{1a}_{1a2a}$. Cross effects on demand are assumed to be present; thus $g^{1a}_{1a2a}$ may be different from $g^{1a}_{1a2b}$. Denote the expected revenues distributors 1 and 2 obtain from allocation {i,j} by $g^1_{ij}$ and $g^2_{ij}$ respectively. This notation allows us to summarize expected revenues succinctly: two examples are $g^1_{1a2a} = g^{1a}_{1a2a}$ and $g^1_{1a1b} = g^{1a}_{1a1b} + g^{1b}_{1a1b}$. As an example of the possible payoffs, if the exhibitor chooses the combination {2a, 1b} the exhibitor receives payoff $b^1_{2a1b} + b^2_{2a1b}$, Distributor 1 receives $g^1_{2a1b} - b^1_{2a1b}$, and Distributor 2 receives $g^2_{2a1b} - b^2_{2a1b}$.

[5] In real-world exhibition contracts exhibitors receive all of the concession revenue (Filson et al. 2000). This provides the exhibitor with some incentive to maximize attendance, which involves considering cross-demand effects. The revenue-sharing contract provides additional incentives to consider cross-demand effects. Repeated dealings also play a role because an exhibitor that does not take a distributor's interests into account may be punished in the future.

Proposition 1 shows that the equilibrium allocation of movies to auditoriums is efficient in the sense that it maximizes the total expected ticket revenue. Proposition 1 also characterizes the equilibrium payoffs of each player. Each distributor receives its marginal contribution to total revenue. For example, Distributor 1 receives the difference between the total expected revenue and what the total expected revenue would be if only Distributor 2's movies were shown in the theater. Proposition 2 establishes the key result of this subsection: the equilibrium allocations with allocation bids can be implemented with contracts that base the exhibitor's payment on ticket revenue without changing the expected payoffs of any player. All proofs are in the appendix.

**Proposition 1:** In equilibrium, when allocation bids are used the allocation of movies to auditoriums is efficient. That is, the allocation {i,j} maximizes $g^1_{ij} + g^2_{ij}$. If there are multiple efficient allocations then every one is a possible equilibrium allocation. The expected payoffs are:

$$\begin{array}{rc} \text{Distributor 1:} & g^1_{ij} + g^2_{ij} - g^2_{2a2b} \\ \text{Distributor 2:} & g^1_{ij} + g^2_{ij} - g^1_{1a1b} \\ \text{Exhibitor:} & g^1_{1a1b} + g^2_{2a2b} - (g^1_{ij} + g^2_{ij}). \end{array} \tag{2.1}$$

**Proposition 2:** Any equilibrium allocation with allocation bids can be implemented with contracts that base the exhibitor's payment on ticket revenue. The expected payoffs are the same as with allocation bids.

In summary, in the presence of cross effects on demand each distributor would like a contract that specifies the exhibitor's entire slate of movies. Because such a contract is prohibitively expensive to negotiate, monitor, and enforce, real-world distributors use instead a contract that bases the exhibitor's payment on ticket revenue. This contract provides the exhibitor with the incentive to maximize the revenue from each of its movies. In our stylized model, basing the exhibitor's payment on ticket revenue implements exactly the same allocations as the allocation bids do - the exhibitor takes all of the cross effects on demand into account. Although real-world exhibition contracts are more complex than those analyzed here it is reasonable to assume that they provide exhibitors with incentives to take cross effects into account, and thus are similar to allocation bids. In the subsections that follow we simply assume that distributors use allocation bids.

### 2.1. Dynamics

Strategic interaction in the basic model above is limited because the game is static. This leads to some unrealistic implications that are at odds with real-world observations. One unrealistic implication is that multiple hits may be shown in the theater at the same time. This is implied by Proposition 1, which states that the equilibrium allocation maximizes total revenue. In contrast, casual observation suggests that release dates of hits are often staggered.[6] Chisholm (1999) provides evidence that confirms this observation, and D. Barry Reardon, president of Warner Brothers Distributing Corporation, writes: "Competition is a crucial issue in targeting a release. Will we be up against a movie with similar audience-segment appeal? Sometimes this leads to moving dates up or back." (Reardon, 1992) Another fact is that the length of the theatrical run varies across movies. Distributor choices about release dates and run lengths interact with their choices of contract terms. In order to explore these phenomena we develop and simulate a dynamic version of the model of the multiplex.

In the dynamic model, two distributors and a single exhibitor with two auditoriums interact over an infinite number of time periods. As above, all players are risk neutral. The distributors maximize their respective values, and discount future period payoffs using a discount factor $\delta = .9$. The exhibitor maximizes current profit, which depends solely on the distributors' bids.

Each period each distributor has two movies in its inventory. Unreleased movies can be held in inventory indefinitely, but a movie can be in the theater for at most two periods, and these periods must be consecutive. After that the movie must be dropped from the

[6] The fact that this occurs shows that avoiding head-to-head competition is a key concern in the movie business. In other industries other concerns might dominate. For example, Doyle and Snyder (1999) show that in the automobile industry if one manufacturer announces an increase in production other manufacturers respond by increasing their production. Announcements reveal private information about common demand parameters, and this effect dominates the desire to avoid head-to-head competition.

distributor's inventory and replaced with a new movie. This captures the main features of real-world releases and runs: delayed releases occur, but when a movie is released an initial contract is signed for four to eight weeks and there is an option for a renewal.[7]

If a movie has been in the theater for two periods then there is no cost in replacing it, but a distributor can replace a movie before the two periods are over by paying a replacement cost of $c$. This assumption reflects the fact that production schedules are typically set years in advance along with tentative release windows, and it is costly to speed up production. In the simulation $c = .25$. A distributor cannot add a new movie to its inventory unless one is replaced - each distributor can hold only two movies in its inventory in any period.

New movies are drawn at random. Each movie is a "hit" with probability .05 and a "flop" with probability .95, where hits earn high expected revenues and flops earn low expected revenues.[8] Noisy public signals of each new movie's type are observed.[9] If a hit signal is observed then the movie is a hit with probability .95, and if a flop signal is observed then the movie is a hit with probability .00263.[10] After a movie has been shown in the theater

[7]In our model new contracts are negotiated each period. Real-world contracts may include holdover clauses that achieve the same result: hit movies are kept in the theater longer. Holdover clauses reduce transactions costs by removing the need for new negotiations. Since we do not include negotiation costs in the model, we will not address this any further.

[8]De Vany and Walls (1996, 1999) show that the distribution of cumulative box office revenues is best-approximated by the Pareto distribution, which is skewed to the right. Thus, hits are rare and flops are the rule.

[9]We assume that a signal of a movie's type is not observed until the movie is added to inventory. Readers familiar with dynamic programming will note that assuming that new movies are randomly drawn helps keep the size of the state space manageable because the only state variables are the characteristics of the movies that are currently held in inventory. Evidence suggests that the assumption is reasonable. De Vany and Walls (1996, 1999) show that the distribution of cumulative box office revenues has an infinite variance. Thus, if new movies are random draws from the distribution of all previous movies then there is no way to forecast box office revenues. When the production schedule is set there is very little movie-specific information available; at *best* a script is available and the main actors are known. Thus, new movies can arguably be regarded as random draws. Chisholm (1999) presents an alternative view and asserts that the movie-specific information that studios observe before production starts is sufficient to plan release schedules to release hits around holiday weekends. However, while this does happen, mistakes are often made, and there is a well-established body of evidence that shows that studio forecasts are often wrong (see Borcherding and Filson, 2001 and the sources cited there). For example, some of the highest-grossing movies in history were initially turned down by studios, including *Star Wars* and *Titanic,* and big bets have been made on flops, too, like *Howard the Duck* and *Ishtar*. Thus, assuming that "nobody knows anything" (Goldman, 1989) at the production stage approximates reality well even if it is not precisely correct. Once the movie has been made, pre-release surveys are performed and signals of its potential are observed. Even then errors are possible; hence we allow for noisy signals.

[10]These numbers reflect the casual observation that studios are more often disappointed by failing with anticipated hits than surprised by succeeding with anticipated flops. Also, the numbers ensure that the signals are unbiased in the sense that the probability of observing a signal of flop is the same as the probability of

its type is revealed.

Given the assumptions, the expected revenue of each movie depend on two factors: each movie is either "new" (unreleased) or "old" (released last period) and is believed to be either a hit or a flop. Typically the demand for a movie on a per-theater basis is highest when it is first released and falls over time.[11] Therefore we assume that old movies earn lower expected revenues than new movies, other things equal. Suppose that the two movies in the theater are A and B. If each movie is a "new flop" then each movie's expected revenue is 1. If A has a hit signal its expected revenue rises by a factor $\gamma > 1$; if B has a hit signal then A's expected revenue falls by a factor $\gamma_c < 1$; if A is old then its expected revenue falls by a factor $\varphi < 1$; if B is old then A's expected revenue rises by a factor $\varphi_c > 1$. For example, if the two movies in the theater are a new hit and an old flop then the new hit has expected revenue $\gamma\varphi_c$ and the old flop has expected revenue $\gamma_c\varphi$. If both are new hits then each has expected revenue $\gamma\gamma_c$. The assumptions on $\gamma_c$ and $\varphi_c$ imply that A and B are substitutes for some consumers.

The demand parameter values chosen ensure that in order to maximize revenue in a given period all new hits should be allocated, then old hits, then new flops, and then old flops. This makes it easy to compare the results of the static and dynamic games because, by Proposition 1, the equilibrium in the static game is always revenue-maximizing. The parameter values used are: $\gamma = 5$, $\gamma_c = .8$, $\varphi = .55$, and $\varphi_c = 1.05$.

Timing in the model is as follows. At the beginning of each period each distributor makes its inventory replacement decision simultaneously. Then, if any movies were replaced, the signals of the new movies' types are observed. Then the distributors offer contracts to the exhibitor. The contracts are allocation bids, as in the above subsection: each distributor submits six allocation bids, one for each possible allocation ({1a,2a}, {1a,1b}, {1a,2b}, {2a,1b}, {2a,2b}, and {1b,2b}). Then the exhibitor chooses an allocation to maximize the sum of the two distributors' bids. Then the uncertainty about the new movies' types is

randomly drawing a flop: solving $p(1 - .00263) + (1 - p)(1 - .95) = .95$ results in $p = .95$. The hit signals are unbiased in the same sense.

[11] De Vany and Eckert (1991), De Vany and Walls (1996, 1999) and Sawhney and Eliashberg (1996) examine time series of ticket revenue. Although most of the analysis is performed using national revenue, the data on revenue per screen suggests that revenue per screen tends to fall over time.

resolved and the period ends. We compute a Markov Perfect Equilibrium: each distributor solves a dynamic programming problem where all choices are functions of the payoff-relevant state variables (the movie types) and are best responses to the other distributor's and the exhibitor's choices.

The payoff matrix of the replacement stage of the game is shown in Figure 1. Figure 1 describes the most general case of the replacement stage - in cases where one or more of the movies was old in the previous period some of the strategies in Figure 1 can be ruled out because movies that were old must be replaced. Note that after the replacement game is played at most two movies out of the total of four held in inventory can be old. All movies that were old in the previous period must be dropped from inventory, and if there are none of these then the only old movies are the two that were shown in the previous period. The notation $W^i_{abab}$ denotes Distributor $i$'s expected value in the case where the distributors keep {1a,1b} and {2a,2b}. The subscript $a'$ is used when $a$ is replaced with a new movie; $b'$ is used similarly. For example, $W^2_{a'bab'}$ denotes Distributor 2's expected value when Distributor 1 replaces 1a and Distributor 2 replaces 2b. All of the $W$'s are expected values because they take into account uncertainty about revenue and movie types.

The simulation algorithm computes all of the Nash equilibria in the replacement game, eliminates any Pareto inferior equilibria, and then computes expected payoffs under the assumption that each remaining equilibrium is selected with equal probability.[12] Denote the expected payoffs that result by $V^1$ and $V^2$. For example, if Distributor 1 keeps both of its movies and Distributor 2 replaces 2a then $V^1 = W^1_{aba'b}$ and $V^2 = W^2_{aba'b}$. In cases with multiple equilibria, $V^1$ and $V^2$ are averages of the relevant $W^1$ and $W^2$ values.

Once replacement decisions have been made the movies' ages and signals are taken as given for the remainder of the period. The equilibrium in the bidding game is similar to the equilibrium in the static game: 1) The allocation maximizes the sum of the distributors' expected values; and 2) Distributor $i$'s expected payoff is the total expected value minus

[12] Assuming that each pure strategy equilibrium is selected with equal probability is simpler than computing mixed strategy equilibria and results in clearer predictions. It also ensures that in situations where the two distributors have identical movie types, their payoffs are identical. The simulation algorithm allows for the possibility that no pure strategy equilibrium exists in the replacement stage, in which case it computes a mixed strategy equilibrium. However, this feature of the algorithm proved to be unecessary, because in every case a pure strategy equilibrium existed.

the total expected payoff that would result if the exhibitor contracted solely with the other distributor.[13] For example, consider the case where each distributor keeps both of its movies at the beginning of the period. Suppose that the equilibrium allocation is {i,j}. Then

$$\begin{aligned} W^1_{abab} &= g_i + g_j + \delta E[V^{1'}(abab; i, j)] + \delta E[V^{2'}(abab; i, j)] \qquad (2.2) \\ &\quad - \{g_{2a2b} + \delta E[V^{2'}(abab; 2a, 2b)]\} \\ W^2_{abab} &= g_i + g_j + \delta E[V^{1'}(abab; i, j)] + \delta E[V^{2'}(abab; i, j)] \qquad (2.3) \\ &\quad - \{g_{1a1b} + \delta E[V^{1'}(abab; 1a, 1b)]\}. \end{aligned}$$

$E[V^{1'}(abab; i, j)]$ is Distributor 1's expected future value of $V^1$ given that the current movies are {1a,1b} and {2a,2b} and that the current allocation is {i,j}. The other expected values are defined similarly. These expectations take into account the fact that any uncertainty about the types of movies i and j is resolved before the next period begins.

The value functions of the two distributors are computed by modifying the common technique for computing dynamic programming problems with single decision makers known as "iterating on the value function" (described by Stokey, Lucas, and Prescott, 1989). The modification allows for two agents to interact. A grid of all the possible values of the state variables (movie ages and types for each distributor) is constructed, and to initiate the iterations the value function of each distributor is set equal to 0 at every grid point. Then the equilibrium of the game is computed at each grid point and new value functions are obtained. This process is repeated until the value functions no longer change.[14]

Table 1 summarizes the simulation results. We focus on cases that lead to delayed new hit releases, so only the inventories in which Distributor 1 has at least one new hit are listed. The identities of the distributors are interchangeable, so the inventories in which Distributor 2 has at least one new hit need not be listed separately. All of the inventories in which

[13] The proof follows the same process as the proof of Proposition 1 - simply replace the distributors' revenues with the distributors' values. For brevity we omit the details.

[14] As far as we are aware there is no general proof of equilibrium existence in this type of environment. However, the value functions converged so the equilibrium must exist, at least at the chosen parameter values. We experimented with varying the parameter values and the equilibrium exists for a large range of parameters.

neither player has a new hit lead to allocations that have the same expected revenue as in the static model - expected revenue is maximized and no strategic delays occur.

The first column in Table 1 lists Distributor 1's inventory, the second lists Distributor 2's inventory, and the third lists all of the possible equilibrium allocations of movies to auditoriums. It is assumed that the replacement game has already been played. For example, the element in the sixth row is {new hit, new hit} {old hit, new flop}; after the replacement game Distributor 1 has two new movies with hit signals and Distributor 2 has an old hit and a new flop. The possible equilibrium allocations in this case are {1a, 2a} and {2a, 1b}. Thus, the equilibrium allocations involve one of Distributor 1's new hits paired with Distributor 2's old hit. This differs from the static case, in which both new hits would be allocated to the theater.

The fourth column in Table 1 indicates whether a delayed release occurs in equilibrium. An entry of "Delay" indicates that the release of a new hit is delayed. In all such cases the equilibrium allocation in the dynamic game differs from the equilibrium allocation in the static game. An entry of "No" indicates that all new hits are released, and an entry of "-" indicates that there are three new hits available and two are released. The results reveal several types of delay strategies. Distributor 1 often delays releasing a new hit to avoid competing with its own or Distributor 2's new or old hits.

In the first set of results in Table 1 Distributor 1 has two new hits. When Distributor 2 also has a new hit, two new hits are placed in the theater. When Distributor 2 does not have a new hit Distributor 1 delays releasing one of its hits. In the static game Distributor 1 would place both new hits in the theater at once but in the dynamic game it is worthwhile to wait and thus avoid the adverse cross effect on demand. The first hit can play out in the theater and then the second one can be released. This is an optimal strategy because it is unlikely that Distributor 2 will obtain a competing new hit soon, given that the probability of drawing a hit is low.

In the second set of results Distributor 1 has a new hit and an old hit. When Distributor 2 has two new hits, two new hits are placed in the theater. When Distributor 2 has only one new hit then the equilibrium allocation never includes both new hits - the release of one is delayed. When Distributor 2 has no new hits Distributor 1 still delays the release of its new hit and lets its old hit play out - all of the equilibrium allocations in these cases include 1b, Distributor 1's old hit, but none include 1a, Distributor 1's new hit.

In the third set of results Distributor 1 has a new hit and a new flop. Again, in several cases Distributor 1 delays releasing its new hit, either to avoid head-to-head competition with Distributor 2's new hit or to wait for Distributor 2's old hit to finish its run. However, the last four cases in this category show that if Distributor 2's movies are of sufficiently low quality (if enough are old or flops) then Distributor 1 does not delay the release of its new hit.

The last set of results describe cases in which Distributor 1 has a new hit and an old flop. As in the third set of results, delay is more likely to occur if Distributor 2's movies are of high quality. However, the relationship is not as simple as in the third set of results: delay occurs when Distributor 2 has an old hit and a new flop but not when Distributor 2 has the higher quality inventory of a new hit and an old flop. The reason for this is that if Distributor 1 delays the release of its new hit when Distributor 2 has a new hit then it has to wait for two periods for Distributor 2's new hit to finish its run, whereas if Distributor 2 has an old hit then Distributor 1 has to wait for only one period for Distributor 2's movie to finish its run. Therefore, Distributor 1 is more willing to delay when Distributor 2 has an old hit.

The equilibrium contract terms have important effects on payoffs and thus influence the decision to delay. The last three columns in Table 1 describe the payoffs of each player: the distributors' values are listed first and then the exhibitor's payoff. The table reveals several interesting patterns. First, taking Distributor 1's inventory as given, Distributor 1's value is higher, the lower the quality of Distributor 2's movies. This follows from expression (2.2), which shows that Distributor 1's value is decreasing in the value generated if only Distributor 2's movies are shown in the theater. Thus, Distributor 1 can increase its value by having hits, but its value increases even more if *it has hits while its competitor has flops* - thus, delaying the release of hits can be value-maximizing.

The second pattern is that the exhibitor's payoff is not always increasing in the quality of the distributors' inventories *or the quality of the movies in the theater.* For example, compare the inventory {new hit, new hit} {new hit, old hit} to the inventory {new hit, new hit} {old hit, old hit}. Clearly the first inventory is of higher quality, and the equilibrium allocation is two new hits, which is better than the allocation of two old hits that results in the second case. However, the exhibitor's payoff is higher in the second case. The intuition from the static model explains why this occurs. Proposition 1 shows that the exhibitor's payoff is increasing in the value that each distributor can generate with an exclusive contract but *decreasing* in the revenue generated by the equilibrium allocation. Thus, the exhibitor prefers states in which each distributor has a high value on its own but where their combined value is low.

The other aspect of dynamic competition we wish to address is early replacement decisions. If early replacements are costless then both distributors make replacements whenever they observe a flop signal because hits earn higher revenue. However, the results are computed under the more reasonable assumption that early replacements are costly: an early replacement costs $c = .25$.

Given the parameter values, early replacements happen in only two cases that rarely occur. In each case, the movies replaced are old flops. In the first case at the beginning of the period each distributor has one new flop and one old flop, and in equilibrium one of the distributors replaces its old flop. In the second case at the beginning of the period one distributor has two old flops and the other has two new hits, and the distributor with two old flops replaces one of its movies. These states rarely occur because they occur as a result of distributors receiving incorrect signals about movie types in the previous period. For example, consider the second case. In order for one distributor to have two new hits while the other has two old flops, the two new hits must have been held in inventory in the previous period while the two flops, which were then new movies, were shown on screen. This could occur in equilibrium only if the two flops were *both anticipated to be hits* - the inventory must have been {new hit, new hit} {new hit, new hit}. If one was anticipated to be a flop, then the results from Table 1 (the case {new hit, new hit} {new hit, new flop}) show that the equilibrium allocation would not include that movie. If both were anticipated to be flops, then the results from Table 1 ({new hit, new hit} {new flop, new flop}) show that one of the new flops would not be allocated to the theater.

### 2.2. Vertical Integration

Several industry practitioners who describe integration between distributors and exhibitors (Friedberg (1992); Murphy (1992); Reardon (1992)) claim that the integrated units operate at arm's length.[15] If this is correct then in our model the integrated and non-integrated cases are identical. It is still interesting, however, to consider what happens if the two units do not operate at arms length. Therefore, in this subsection we explore what changes if Distributor 2 owns the exhibitor and the two units operate as one. The timing in the model remains the same: at the beginning of each period both distributors make replacement decisions simultaneously, then public signals of the new movies' types are observed, then Distributor 1 submits a list of allocation bids to Distributor 2, and then Distributor 2 chooses which two movies to show in the theater.

In the static model the equilibrium allocations are the same whether Distributor 2 owns the exhibitor or not: the allocations maximize expected revenue. Proposition 1 is modified, but only slightly: Distributor 1's payoff does not change, but Distributor 2 gets $g^2_{2a2b}$, the sum of its payoff and the exhibitor's payoff. However, in the dynamic model there is a difference between the two cases because when Distributor 2 owns the exhibitor the distributor can take a long-run view and make decisions to maximize the *value* of the joint concern. Recall that above the independent exhibitor focused on maximizing current revenue.

In the dynamic game with integration Distributor 2's payoff is always determined by the quality of its own movies, as in the static game. For any inventories {1a,1b} and {2a,2b} Distributor 2's expected value is

$$W^2_{abab} = g_{2a2b} + \delta E[V^{2'}(abab; 2a, 2b)]$$

for every possible equilibrium allocation. This means that Distributor 2 always obtains the full value of any improvement in its movies' qualities *whether its movies are placed in the theater or not.* In the non-integrated case, gains may be competed away through bidding

[15] A. Alan Friedberg is the Chairman of Loews Theatres, a subsidiary of Sony Pictures Entertainment. A.D. Murphy is a financial editor and reporter for *Daily Variety* and *Variety.* D. Barry Reardon is the president of Warner Brothers Distributing Corporation and a former executive of both Paramount Pictures and General Cinema Corporation.

and the independent exhibitor may end up with them.

The first result is that the distributors avoid head-to-head competition with hits moreso than in the non-integrated case. Table 2 compares allocations in the non-integrated and integrated cases. Only those inventories in which the one-period revenues differ in the two cases are listed. The first column describes each distributor's inventory. The second column lists the possible equilibrium allocations. To facilitate comparisons the allocations in the non-integrated case are listed underneath the allocations in the integrated case. The third column lists the future state that is most likely to occur given the current state and the equilibrium allocation. For example, in the first row Distributor 1 has two new hits and Distributor 2 has a new hit and an old hit. The equilibrium allocations include one of Distributor 1's new hits and Distributor 2's old hit. Distributor 1's new hit that is held in inventory is a new hit next period and its new hit that is placed in the theater is most likely to be an old hit next period (unless the hit signal was incorrect). Distributor 2's new hit is a new hit next period and the old hit must be replaced with a new movie, which is most likely to be a flop given the odds of drawing hits and flops. Therefore, the most likely state next period is {new hit, old hit}{new hit, new flop}.

The third column in Table 2 provides intuition for why more delay occurs in the integrated case. In all of the cases except the fourth, delay does not change Distributor 1's future state but improves Distributor 2's. Because Distributor 2's value depends entirely on the quality of its own movies, all of the returns to improvements in its movies' qualities are captured by itself. In the non-integrated case some of these returns are shared with the independent exhibitor. In the fourth case, Distributor 2's state does not improve by delaying, but delay is still profitable because it continues beyond the initial period: if the state at the beginning of the next period is {new hit, old flop}{new hit, old hit} then in equilibrium one new hit is paired with the old hit - the release of the other new hit is delayed until the following period. In the non-integrated case the state at the beginning of next period is most likely to be {old hit, new flop}{new hit, old hit}, and in this case the two old hits are put in the theater. Thus, the hits finish their runs sooner in the non-integrated case.

The second result is that the distributors are more willing to replace their movies early. Distributor 2 replaces both of its movies *whenever it does not have a hit.* Thus, Distributor

2 often replaces new and old flops. The intuition for why more replacements occur is that in the integrated case Distributor 2's payoff is always determined by the quality of its own movies. Interestingly, Distributor 1 also makes more early replacements. Table 3 lists the allocations that lead Distributor 1 to make early replacements. In some cases Distributor 1 replaces new flops. The intuition for why this occurs is that if a flop is old then it can be replaced for free after waiting a single period, whereas in order to replace a new flop for free the distributor must wait two periods. Therefore, the distributor may be more willing to bear the replacement cost to replace a new movie than an old one. The benefit of making an early replacement is that the distributor has a chance to obtain a new hit.

In sum, the model predicts two effects of vertical integration. First, delayed releases occur more often. Second, movie turnover is higher. The second result implies that when distributors own theaters, more movies are made, but the flops stay in inventory for shorter periods of time. Whether these effects can be observed in reality is an interesting empirical question that is beyond the scope of this paper. We note that in the 1940s and 1950s, when the large studios were forced to sell their theaters to comply with the *Paramount* decrees, movie production fell (De Vany and Eckert, 1991). This is consistent with the model's prediction that more movies are made when distributors and exhibitors are integrated. However, this is not a conclusive test because other factors also contributed to the decline in movie production after the *Paramount* decrees. For example, television began to diffuse and as a result demand for B movies fell.

The welfare consequences of integration are not clear. In general, delaying consumption lowers utility because future payoffs are discounted, but in the case of movies consumers might prefer staggered release dates because movies are time-intensive to watch - watching one hit movie per week over several weeks may be preferred to watching several hits in a single week and then seeing no hits for several weeks. If so, then total attendance is increased by staggering the releases of hits. In our parameterization of the model we have assumed that this is the case - hits earn higher revenues if they are not placed in the theater at the same time as other hits.

## 3. Conclusion

This paper introduces a dynamic equilibrium model in a common agency framework and uses the model to explain practices that movie distributors use to avoid head-to-head competition. Exhibition contract terms interact with other strategic choices, the main one being the decision to delay the release of new hits. In the model several types of delay strategies are employed: Distributors avoid releasing two new hits at once and let their old hits play out before releasing their new ones. They also avoid releasing new hits when their competitors are releasing new hits and let their competitors' old hits play out. Distributors are more prone to avoid head-to-head competition when the theater is owned by one of the distributors, and inventory turnover is higher in this case. Other types of competition could be explored in future work. We have not explored the consequences of block booking, nor have we considered competition at the stage of setting up production schedules.

We have focused on vertical relationships in the movie business, but future work might examine how strategies for avoiding head-to-head competition differ across industries that have different demand conditions. The interactions between contract choice and optimal product introduction and placement strategies could be studied in further detail. Also, the dynamic model developed here might be applied to analyze non-retail environments in which multiple decision makers attempt to influence a third party.

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**Appendix**

**Proof of Proposition 1:** Note that if {i,j} is an equilibrium allocation the exhibitor must prefer it to showing both of 1's movies or both of 2's:

$$b^1_{ij} + b^2_{ij} \geq b^1_{1a1b} \tag{3.1}$$
$$b^1_{ij} + b^2_{ij} \geq b^2_{2a2b}. \tag{3.2}$$

Because the distributors are optimizing, both must prefer their payoff from {i,j} to their payoff from excluding the other distributor:

$$g^1_{ij} - b^1_{ij} \geq g^1_{1a1b} - b^1_{1a1b} \tag{3.3}$$
$$g^2_{ij} - b^2_{ij} \geq g^2_{2a2b} - b^2_{2a2b} \tag{3.4}$$

Rearrange expression (3.3) to obtain

$$b^1_{1a1b} \geq g^1_{1a1b} - g^1_{ij} + b^1_{ij}. \tag{3.5}$$

Sub this into expression (3.1) and cancel terms to obtain

$$b^2_{ij} \geq g^1_{1a1b} - g^1_{ij}. \tag{3.6}$$

Distributor 2's goal is to minimize $b^2_{ij}$ subject to the constraint that the allocation is {i,j}. Thus, expression (3.6) imposes a lower bound on $b^2_{ij}$. Given our focus on equilibria that are Pareto-undominated for the distributors, we suppose expression (3.6) binds and that the analogous inequality for distributor 1 binds:

$$b^2_{ij} = g^1_{1a1b} - g^1_{ij} \tag{3.7}$$
$$b^1_{ij} = g^2_{2a2b} - g^2_{ij} \tag{3.8}$$

If these bids are accepted, then the equilibrium payoffs are

$$\begin{aligned} &\text{Distributor 1:} && g^1_{ij} - b^1_{ij} = g^1_{ij} + g^2_{ij} - g^2_{2a2b} \\ &\text{Distributor 2:} && g^2_{ij} - b^2_{ij} = g^1_{ij} + g^2_{ij} - g^1_{1a1b} \\ &\text{Exhibitor:} && b^1_{ij} + b^2_{ij} = g^1_{1a1b} + g^2_{2a2b} - (g^1_{ij} + g^2_{ij}). \end{aligned} \tag{3.9}$$

All that remains is to find bids on the other allocations that ensure that each player is optimizing. Consider the following bids on an arbitrary allocation {k,l}:

$$b^1_{kl} = g^1_{kl} - g^1_{ij} + b^1_{ij} \tag{3.10}$$

$$b^2_{kl} = g^2_{kl} - g^2_{ij} + b^2_{ij} \tag{3.11}$$

By construction these bids ensure that each distributor receives the same payoff from {i,j} as {k,l}. Thus, both distributors are best-responding - neither has an incentive to raise its bid for {k,l}. Simple algebra establishes that the exhibitor prefers {i,j} as long as

$$g^1_{ij} + g^2_{ij} \geq g^1_{kl} + g^2_{kl}. \tag{3.12}$$

Therefore, an equilibrium exists that maximizes total revenue, and the distributor payoffs in expression (3.9) establish that this equilibrium Pareto dominates all others from the point of view of the distributors. ■

**Proof of Proposition 2:** Suppose that {i,j} is an equilibrium allocation when allocation bids are used. Suppose that instead of using allocation bids each distributor simply charges the exhibitor a fixed fee and then allows the exhibitor to choose the allocation of movies to screens. Suppose that Distributor 1 charges the the exhibitor the fixed fee $f_1$, where

$$f_1 = g^1_{ij} + g^2_{ij} - g^2_{2a2b}, \tag{3.13}$$

Similarly, suppose that Distributor 2 charges the exhibitor the fixed fee $f_2$, where

$$f_2 = g^1_{ij} + g^2_{ij} - g^1_{1a1b}, \tag{3.14}$$

If the exhibitor pays $f_1 + f_2$ and then chooses the two movies that maximize its revenue, then by construction each distributor receives the same payoff as in the allocation bidding case. By Proposition 1 {i,j} is a possible choice. The exhibitor's payoff is:

$$g_{ij}^1 + g_{ij}^2 - (f_1 + f_2) = g_{1a1b}^1 + g_{2a2b}^2 - (g_{ij}^1 + g_{ij}^2), \tag{3.15}$$

which is the same as with allocation bids.

To see why $f_1$ and $f_2$ are equilibrium fixed fees, take $f_2$ as given and suppose that Distributor 1 tries to raise $f_1$. The exhibitor would best respond by choosing the allocation {2a,2b}, for which it would receive the payoff

$$g_{2a2b}^2 - f_2 = g_{1a1b}^1 + g_{2a2b}^2 - (g_{ij}^1 + g_{ij}^2). \tag{3.16}$$

Thus, Distributor 1 cannot make itself better off by raising $f_1$. A similar argument shows that Distributor 2 cannot make itself better off by raising $f_2$. ■

**Figure 1. The Replacement Stage of the Game**

| | | Dist. 2 | | | |
|---|---|---|---|---|---|
| | | Keep Both | Replace 2a | Replace 2b | Replace Both |
| | Keep Both | $W^1_{abab}, W^2_{abab}$ | $W^1_{aba'b}, W^2_{aba'b}$ | $W^1_{abab'}, W^2_{abab'}$ | $W^1_{aba'b'}, W^2_{aba'b'}$ |
| Dist. | Replace 1a | $W^1_{a'bab}, W^2_{a'bab}$ | $W^1_{a'ba'b}, W^2_{a'ba'b}$ | $W^1_{a'bab'}, W^2_{a'bab'}$ | $W^1_{a'ba'b'}, W^2_{a'ba'b'}$ |
| 1 | Replace 1b | $W^1_{ab'ab}, W^2_{ab'ab}$ | $W^1_{ab'a'b}, W^2_{ab'a'b}$ | $W^1_{ab'ab'}, W^2_{ab'ab'}$ | $W^1_{ab'a'b'}, W^2_{ab'a'b'}$ |
| | Replace Both | $W^1_{a'b'ab}, W^2_{a'b'ab}$ | $W^1_{a'b'a'b}, W^2_{a'b'a'b}$ | $W^1_{a'b'ab'}, W^2_{a'b'ab'}$ | $W^1_{a'b'a'b'}, W^2_{a'b'a'b'}$ |

**Table 1. The allocation of movies to screens with two distributors and an independent exhibitor in a dynamic setting (inventories in which Distributor 1 has a new hit)**

| Dist. 1's Inventory {1a, 1b} | Dist. 2's Inventory {2a, 2b} | Equil. Allocations | Delays | Dist 1's payoff | Dist 2's payoff | Ex's payoff |
|---|---|---|---|---|---|---|
| | | | | | | |
| **{new hit, new hit}** | {new hit, new hit} | {1a 1b} {2a 2b} | - | 13.47 | 13.47 | 3.18 |
| | {new hit, old hit} | {1a 2a} {2a 1b} | - | 13.75 | 11.55 | 2.99 |
| | {new hit, new flop} | {1a 2a} {2a 1b} | - | 14.49 | 11.66 | 2.25 |
| | {new hit, old flop} | {1a 2a} {2a 1b} | - | 14.46 | 11.55 | 2.28 |
| | {old hit, old hit} | {2a 2b} | Delay | 14.97 | 9.61 | 3.08 |
| | {old hit, new flop} | {1a 2a} {2a 1b} | Delay | 15.47 | 8.91 | 2.64 |
| | {old hit, old flop} | {1a 2a} {2a 1b} | Delay | 15.63 | 9.01 | 2.42 |
| | {new flop, new flop} | {1a 2a} {1a 2b} {2a 1b} {1b 2b} | Delay | 17.19 | 8.67 | 1.05 |
| | {new flop, old flop} | {1a 2a} {2a 1b} | Delay | 17.24 | 8.69 | 0.87 |
| | {old flop, old flop} | {1a 2a} {1a 2b} {2a 1b} {1b 2b} | Delay | 17.12 | 8.30 | 0.93 |
| | | | | | | |
| **{new hit, old hit}** | {new hit, new hit} | {1a 2a} {1a 2b} | - | 11.55 | 13.75 | 2.99 |
| | {new hit, old hit} | {1a 1b} {1a 2b} {2a 1b} {2a 2b} | Delay | 11.52 | 11.52 | 3.18 |
| | {new hit, new flop} | {2a 1b} | Delay | 12.17 | 11.44 | 2.55 |
| | {new hit, old flop} | {1a 1b} {2a 1b} | Delay | 12.23 | 11.52 | 2.47 |
| | {old hit, new flop} | {2a 1b} | Delay | 13.56 | 9.11 | 2.58 |
| | {new flop, new flop} | {2a 1b} {1b 2b} | Delay | 14.61 | 8.42 | 1.60 |
| | {new flop, old flop} | {2a 1b} | Delay | 14.95 | 8.50 | 1.19 |
| | | | | | | |
| **{new hit, new flop}** | {new hit, new hit} | {1a 2a} {1a 2b} | - | 11.66 | 14.49 | 2.25 |
| | {new hit, old hit} | {1a 2b} | Delay | 11.44 | 12.17 | 2.55 |
| | {new hit, new flop} | {1a 2b} {2a 1b} | Delay | 11.84 | 11.84 | 2.08 |
| | {new hit, old flop} | {2a 1b} | Delay | 11.81 | 11.83 | 2.18 |
| | {old hit, old hit} | {2a 2b} | Delay | 12.45 | 9.71 | 3.01 |
| | {old hit, new flop} | {2a 2b} | Delay | 12.84 | 9.00 | 2.69 |
| | {old hit, old flop} | {1a 2a} | No | 13.03 | 9.02 | 2.43 |
| | {new flop, new flop} | {1a 2a} {1a 2b} | No | 14.29 | 8.62 | 1.38 |
| | {new flop, old flop} | {1a 2a} | No | 14.63 | 8.80 | 0.91 |
| | {old flop, old flop} | {1a 1b} | No | 15.09 | 8.88 | 0.37 |
| | | | | | | |
| **{new hit, old flop}** | {new hit, new hit} | {1a 2a} {1a 2b} | - | 11.55 | 14.46 | 2.28 |
| | {new hit, old hit} | {1a 2b} {2a 2b} | Delay | 11.52 | 12.23 | 2.47 |
| | {new hit, new flop} | {1a 2b} | Delay | 11.83 | 11.81 | 2.18 |
| | {new hit, old flop} | {1a 2a} | No | 11.83 | 11.83 | 2.17 |
| | {old hit, new flop} | {2a 2b} | Delay | 12.96 | 9.22 | 2.47 |
| | {new flop, new flop} | {1a 2a} {1a 2b} | No | 14.37 | 8.88 | 1.14 |
| | {new flop, old flop} | {1a 2a} | No | 14.76 | 9.03 | 0.67 |

**Table 2. Comparison of the non-integrated allocations to the case in which Distributor 2 owns the exhibitor (inventories in which the one-period revenues differ in the two cases)**

| **Strategies**<br>Inventories: {1a, 1b} {2a, 2b} | **Allocations:**<br>Integrated Case<br>Non-Integrated Case | **The state that is most likely to occur at the beginning of next period** |
|---|---|---|
| | | |
| {new hit, new hit} {new hit, old hit} | {1a, 2b} {1b, 2b} | {new hit, old hit} {new hit, new flop} |
| | {1a, 2a} {2a, 1b} | {new hit, old hit} {old hit, new flop} |
| | | |
| {new hit, old hit} {new hit, new hit} | {1a, 1b} | {old hit, new flop} {new hit, new hit} |
| | {1a, 2a} {1a, 2b} | {old hit, new flop} {new hit, old hit} |
| | | |
| {new hit, new hit} {new hit, new flop} | {1a, 2b} {1b, 2b} | {new hit, old hit} {new hit, old flop} |
| | {1a, 2a} {2a, 1b} | {new hit, old hit} {old hit, new flop} |
| | | |
| {new hit, new flop} {new hit, new hit} | {2a, 1b} {1b, 2b} | {new hit, old flop} {new hit, old hit} |
| | {1a, 2a} {1a, 2b} | {old hit, new flop} {new hit, old hit} |
| | | |
| {new hit, old flop} {new hit, old flop} | {1a, 1b} {1a, 2b} | {old hit, new flop} {new hit, new flop} |
| | {1a, 2a} | {old hit, new flop} {old hit, new flop} |
| | | |
| {old hit, old flop} {new hit, new flop} | {1a, 2b} | {new flop, new flop} {new hit, old flop} |
| | {1a, 2a} | {new flop, new flop} {old hit, new flop} |

**Table 3. Distributor 1's early replacements in the integrated case**

| **Inventories: {1a,1b} {2a,2b}** | **Movies Replaced** |
|---|---|
| | |
| {new flop, new flop} {new flop, new flop} | 1a or 1b |
| {new flop, new flop} {new flop, old flop} | 1a or 1b |
| {new flop, new flop} {old flop, old flop} | 1a or 1b |
| {old flop, old flop} {new hit, new hit} | 1a or 1b |