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Relational Adaptation Under Reel Authority

Daniel Barron,[a] Robert Gibbons,[b] Ricard Gil,[c] Kevin J. Murphy[d]

[a] Kellogg School of Management, Northwestern University, Evanston, Illinois 60208; [b] MIT Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; [c] Smith School of Business, Queen's University, Kingston, Ontario K7L 2P3, Canada; [d] USC Marshall School of Business, University of Southern California, Los Angeles, California 90089

Contact: d-barron@kellogg.northwestern.edu (DB); rgibbons@mit.edu, http://orcid.org/0000-0001-6765-3039 (RoG); ricard.gil@queensu.ca, http://orcid.org/0000-0003-3627-0988 (RiG); kjmurphy@usc.edu (KJM)

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Abstract. We study relationships between parties who have different preferences about how to tailor decisions to changing circumstances. Our model suggests that relational contracts supported by formal contracts may achieve *relational adaptation* that improves on adaptation decisions achieved by formal or relational contracts alone. Our empirics consider revenue-sharing contracts between movie distributors and an exhibitor. The exhibitor has discretion about whether and when to show a movie, and the parties frequently renegotiate formal contracts *after* a movie has finished its run. We document that such ex post renegotiation is consistent with the distributor rewarding the exhibitor for adaptation decisions that improve their joint payoffs.

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1. Introduction

As Hayek (1945, p. 521) emphasized, a well-functioning economic system must motivate parties to adapt rapidly to changes in "the particular circumstances of time and place." Although Hayek's focus was on the economy as a whole, his observation is equally relevant for many transactions between and within firms, where circumstances may change suddenly and require rapid responses. For example, upstream and downstream firms in a supply relationship adapt their activities to changes in costs and demand, plant managers adjust operations in response to maintenance needs or utilize slack capacity, and supervisors assign projects based on employees' skills and workloads.

In some settings, adaptation can be achieved by planning ahead—for instance, by using state-contingent contracts as in Arrow (1953). In other settings, adaptation can be achieved in real time, as illustrated by the way markets adapt to dispersed information in Grossman (1981). But there are many important cases that fall between these extremes—cases where it would be impossible or prohibitively costly to achieve efficient adaptation using either state-contingent formal contracts ex ante or market clearing ex post. In such cases, firms may use informal agreements in long-term relationships to facilitate efficient adaptation decisions.[1] These relational contracts leverage the surplus from future interactions to dissuade parties from succumbing to privately beneficial but collectively damaging temptations.[2]

This paper studies ongoing relationships in which parties typically have different preferences about how to adapt decisions to a fluctuating state of the world. Our empirical work explores the causes and consequences of *relational adaptation* (i.e., self-enforcing agreements facilitating adaptation decisions that improve joint payoffs). To guide our empirics, we construct a simple model showing how relational adaptation can supplement incomplete formal contracts in long-term relationships. Together, our empirical and theoretical results suggest that formal contracts can be the foundation for informal relationships that improves adaptation in fluctuating environments.[3]

Our empirics exploit an attractive setting for studying relational adaptation: revenue-sharing contracts and movie exhibition decisions between distributors and an exhibitor in the movie industry. In this industry, when a distributor (for our purposes, the owner of a movie) and the exhibitor (in our setting, the owner of multiple theaters) are separate firms, they often sign a formal contract to share the box office revenues generated by the distributor's movie. These contracts are typically signed well before the movie's release, so although they specify weekly sharing rates if the movie is shown, they do not require the exhibitor to show the movie in any given week, nor do they dictate how many times a day, in what time slots, or against what other movies that movie shall be shown. That is, once the movie (or, because there may be multiple copies of the same movie, the "reel") arrives at a theater, the *reel authority* rests with the exhibitor.[4]

We focus on two related features of these exhibitor–distributor relationships. First, many factors that influence the parties' payoffs from adaptation decisions are both uncertain when the contract is signed and costly to capture in a formal agreement. In particular, the exhibitor's decision to show a movie on a dedicated or shared screen depends on the opportunity cost of doing so, which depends in turn on the performance of the movies that might otherwise be shown on that screen during those times. In our data, formal revenue-sharing terms do not condition on these opportunity costs.

A second striking feature of these exhibitor–distributor relationships may be caused by the first: the formal contract is frequently renegotiated to give the exhibitor a larger share of the box office revenue, and this renegotiation occurs *after* the movie has finished its run—weeks later than any decisions the exhibitor made that affect that movie's revenues. We explore whether these ex post renegotiations may be compensating the exhibitor for earlier adaptation decisions, with unilateral financial concessions by a distributor made credible by the prospect of future interactions between the exhibitor and the distributor in question. For ease of exposition, we define efficient adaptation decisions as those that maximize the joint payoffs for these two parties.

Whereas this description and our model treat the distributor–exhibitor pair as the critical relationship, the distributor is often an intermediary between the studios (who produce and own the movie) and the exhibitor (who shows the movie). We could equivalently have modeled the exhibitor–studio relationship, treating the distributor as a passive intermediary. In our empirical work, we examine both distributor–exhibitor and studio–exhibitor relationships.

In our data, we observe (i) the formal contract, (ii) ex post renegotiation of that contract, if it occurs, and proxies for both (iii) adaptation decisions and (iv) the opportunity cost of those decisions. We therefore can study whether ex post renegotiations do, in fact, compensate the exhibitor for showing a movie when the exhibitor's opportunity cost of doing so is high, as well as whether the promise of these relational payments influences the exhibitor's adaptation decisions. We also explore whether the exhibitor's adaptation decisions systematically favor distributors (or studios) that have previously paid larger relational discounts, which serves as a proxy for the strength of the exhibitor's relationship with that distributor (or studio).

We conclude this introduction with an overview of the paper and a review of related literatures. Section 2 then describes the institutional setting, Section 3 develops a simple model, and Section 4 tests for relational adaptation in our data. Section 5 concludes.

1.1. Overview

We explore relational adaptation using weekly data on contract terms and box office outcomes from 26 movie theaters in Spain. Specifically, we combine Gil's (2013) data on contracted and renegotiated revenue shares with new data: screen-by-screen box office revenues for the 18 months between January 2001 and July 2002. Combining these data sets allows us to study the exhibitor's decision whether to show a reel for an additional week, as well as the decision to show the reel as the only movie on a given screen (a "dedicated" screen) versus as one of two or more movies showing on that screen (a "shared" screen). These new data also allow us to develop proxies for exhibitor opportunity costs: expected revenues from reels available to the exhibitor that could have been shown instead of, or on a screen shared with, the movie in question.

In our data, ex post renegotiations (when they occur) favor the exhibitor: that is, the distributor accepts a smaller share of the box office revenues than specified under the formal contract—a renegotiation we henceforth call a "discount." Relational discounts vary for the same movie not only across weeks but also across theaters within a week. Our empirical results include both theater and movie-week fixed effects, allowing us to link across-theater variation in discounts within a movie-week to across-theater variation in the opportunity cost of showing that movie that week.

We motivate our empirical analysis with a simple model of relational adaptation, in which a single distributor and a single exhibitor sign a formal revenue-sharing contract before the exhibitor learns her opportunity cost (e.g., the payment she would receive from showing an alternative movie). We show that relational discounts encourage efficient adaptation by rewarding the exhibitor for showing the distributor's movie when the opportunity cost of doing so lies between the revenue from showing the movie and the payment specified by the formal contract alone. To link this model to our data, we posit that the exhibitor's opportunity cost is positively related to the highest anticipated box office revenues of (a) reels from the prior week that could have been shown but were not and (b) reels shown on shared screens that could have been shown on dedicated screens but were not.

Although stylized, our model suggests three hypotheses. First, renegotiation should occur more frequently, and the resulting discounts should be larger, when the exhibitor's opportunity cost of showing a given reel is larger. Second, these discounts should induce the exhibitor to continue reels that she would otherwise drop or continue a reel on a dedicated screen that she would otherwise have assigned to a shared screen. Third, distributors (or studios) who have stronger relationships with the exhibitor should be willing to pay larger discounts, and the exhibitor should therefore continue showing those distributors' (or studios') movies even when the opportunity costs of doing so are larger.

We find empirical support for all three hypotheses, controlling for potential differences across theaters using theater fixed effects and for distributor-, movie-, or week-specific factors using reel-week fixed effects.[5] Consistent with our first hypothesis, we find that both the incidence and magnitude of the relational discounts for continued reels are positively and significantly related to our proxies for exhibitor opportunity costs. Consistent with our second hypothesis, we find that these discounts are associated with continuation decisions: the exhibitor's decision to continue a reel when faced with high opportunity costs is correlated with a larger and more likely discount after the movie's run is completed. Finally, consistent with our third hypothesis, we find that reels with high opportunity cost are more likely to be continued when they come from distributors or studios with a history of providing large discounts on such reels.

1.2. Literature

To the best of our knowledge, our paper is the first to investigate how formal contracts and informal relationships facilitate *relational adaptation* using routine variation in the underlying economic environment. For example, Macchiavello and Morjaria (2015) use a single unanticipated shock as a source of variation for the actions taken by flower growers and buyers; by contrast, we use frequent variation in opportunity costs, such as across theaters and weeks for a given movie.

Our paper complements research that emphasizes *adaptation* in a variety of economic settings, including Masten and Crocker (1985) and Crocker and Masten (1988, 1991) on natural gas, Crocker and Reynolds (1993) on defense procurement, Poppo and Zenger (2002) on information services, Mukherji and Francis (2008) on automotive supply chains, and Forbes and Lederman (2009) on airlines. However, we emphasize how informal promises in ongoing relationships can facilitate adaptation, whereas the (explicit or implicit) models in these papers analyze adaptation in one-shot transactions such as take-or-pay contracts.

Our paper also relates to the broader literature on *relational contracting* and the interplay between relational and formal contracts. Macaulay (1963) and Macneil (1978) are early contributions to this literature from sociology and law, respectively. In economics, Bull (1987), MacLeod and Malcomson (1989), and Levin (2003) established the theoretical literature on relational contracting; Baker et al. (1994) did likewise for the interplay between formal and relational contracting; and McMillan and Woodruff (1999) provided early empirical work. See Malcomson (2013) and Gil and Zanarone (2018) for surveys of theory and evidence, respectively.

In our setting, relational payments take the form of ex post discounts from formal contracts, so our paper is connected to the literature on *contract renegotiation*. An empirical literature has studied renegotiation of long-term contracts in a wide variety of settings, including the petroleum coke industry (Goldberg and Erickson 1987), lease obligations for U.S. airlines in financial distress (Benmelech and Bergman 2008), and incentive contracts in the banking industry (Cai et al. 2010). In contrast to those papers, renegotiation in our setting is a unilateral ex post payment from the distributor to the exhibitor that occurs after all decisions about a given movie have been taken rather than a simultaneous quid pro quo. We thus contribute to this empirical literature by suggesting that parties might renegotiate contracts in order to compensate for *past* actions rather than to change contracts influencing *future* behaviors. Our focus on how ex post renegotiation compensates decision makers for past decisions also differs from much of the theoretical literature on contract renegotiation, which considers how renegotiation either affects ex ante investment incentives (Hart and Moore 1988, Aghion et al. 1994) or influences later actions (Hart and Moore 2008).

Finally, we join those studying formal *distributor–exhibitor contracts* in the movie industry.[6] Existing studies interpret ex post discounts in a movie's formal contract as a response to unexpected shocks in *that* movie's box office revenue. For example, Filson et al. (2005) interpret discounts as facilitating risk sharing, Gil and Lafontaine (2012) argue that discounts help achieve state-dependent pricing, and Gil (2013) views discounts as compensating exhibitors for movies that do worse than expected.[7] We differ from these papers by showing that ex post discounts respond to the *opportunity cost* of showing a movie rather than just its (contractible) box office revenue. We also provide evidence that the exhibitor's decisions respond to promised discounts, which suggests that renegotiation encourages efficient adaptation to the (not easily contractible) opportunity cost of showing a movie.

2. Exhibitor–Distributor Contracts in Spain

2.1. Institutional Background

Our empirical analysis uses detailed weekly data on the contracts between a single Spanish exhibitor and several movie distributors during the 18 months between January 2001 and July 2002. During that period, the exhibitor owned 188 screens in 26 theaters located in 16 different cities in 11 Spanish provinces. Each formal contract between a distributor and an exhibitor in this market covers a reel of a film at one of the exhibitor's theaters. For a given reel, the contract is simple and specifies the share of the box office revenues to be paid to the distributor if that reel is shown in a given week. This contract typically specifies sharing rates for up to eight or more weeks after the release date, although the exhibitor is free to end a movie's run earlier (or later).

As illustrated in Table 1 and documented in Gil (2013), however, the negotiation process leading to this simple contract can be long and complex. For our purposes, the key feature of this negotiation is that the parties agree to weekly formal revenue-sharing rates several weeks before the corresponding movie is released, at which point there is still substantial uncertainty about the performance of alternative reels that could be shown instead. By contrast, renegotiation typically occurs (long) after a movie has left theaters, at which point this uncertainty about opportunity costs has been resolved.[8] See Table 1 for a detailed timeline.

While the formal contract specifies the distributor's revenue share in the event the reel is shown, the exhibitor retains decisions rights over whether to show the reel, how often, and in what time slots. In our theoretical and empirical analysis, we consider two types of continuation decisions. The first is whether to continue showing a particular reel in a particular theater in a prime-time slot for an additional week.[9] The second is whether to show a particular reel during all the prime-time slots on a given screen or instead to share prime-time slots on that screen with another movie.[10]

There is a fundamental conflict of interest between the distributor and the exhibitor with respect to both (a) dropping a movie entirely and (b) moving it from a dedicated to a shared screen. On the one hand, once a reel is produced and sent to a theater, the distributor's opportunity cost of an additional screening at that theater is negligible, and the distributor will therefore prefer the reel to be shown whenever the marginal revenue from doing so is strictly positive.[11] On the other hand, the exhibitor's opportunity cost of showing the reel on a given screen in a given time slot equals the exhibitor's profit from the best alternative reel that could be shown instead, which will be strictly positive as long as the exhibitor has fewer screens than available reels. Therefore, an exhibitor facing a high opportunity cost will be tempted either to discontinue the distributor's reel or to show it in fewer or worse time slots than those preferred by the distributor.[12]

The formal contract mitigates this temptation in several ways. For example, because revenues from a given movie typically decline over time, the exhibitor's formal share of the box office revenue typically increases later in a movie's run. However, new information affecting the efficient continuation decision that maximizes exhibitor–distributor surplus—such as unanticipated box office revenues, new releases that might perform better or worse than expected, and so on—emerges continuously during the run of a movie. Thus, the formal contract alone might not induce the exhibitor to make distributors' preferred continuation decisions. In those cases, we hypothesize that the promise of a future discount encourages the exhibitor to adapt her decisions to changing circumstances. These future discounts are made credible by the promise of interactions between the exhibitor and that distributor even further in the future.

2.2. An Example: *A Beautiful Mind*

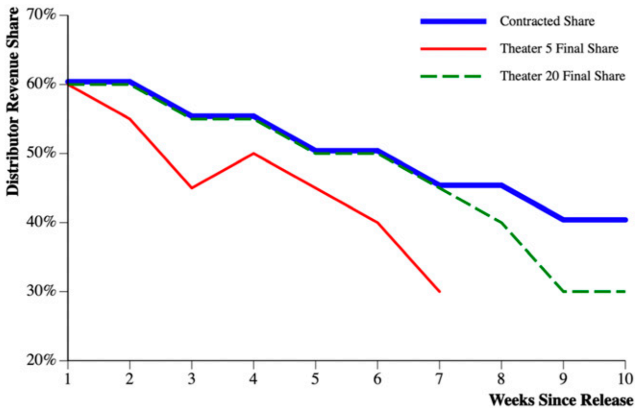
To illustrate several features of our data, Figure 1 shows the weekly formal and relational (i.e., renegotiated)

Table 1. Timeline for the Distributor–Exhibitor Revenue-Sharing Contract

Typical timing of contract negotiation	Actions
Months before a movie is released	Distributor and exhibitor agree on the total number of reels allocated to the exhibitor.
After the movie release date is determined	The distributor and exhibitor allocate the total number of reels among the exhibitor's theaters.
A month to a week before the movie is released	The distributor and exhibitor negotiate a formal revenue-sharing rate for each theater, reel, and week. The distributor promotes the movie to audiences.
Each week during the movie's run	The exhibitor chooses whether, when, and how many times the movie is shown in her theaters.
After the movie has finished its run	The distributor and exhibitor renegotiate the formal contract.

Notes. The typical distributor–exhibitor contract covers a single reel of a movie at a theater. The formal contracts themselves are relatively simple and consist of week-by-week sharing rates for several weeks along with a set of boilerplate clauses. Unlike the analogous agreements in the United States, these contracts typically do not include any fixed payment to the exhibitor.

Figure 1. (Color online) Contracted and Final Sharing Rates for *A Beautiful Mind* in Select Theaters



sharing rates for two theaters showing the John Nash biopic *A Beautiful Mind* (or *Una Mente Maravillosa* in Spain), released in Spain on February 22, 2002 (nine weeks after its release in the United States). The figure shows that—for this movie in these two theaters—the distributor's formal share decreased over the movie's run, and the likelihood and size of the exhibitor's negotiated discount increased. In particular, the formal sharing rate for the distributor decreased by 5% every two weeks, from 60% in week 1 to 40% by week 10. The movie played for 7 weeks in Theater 5 and for 10 weeks in Theater 20.[13] Theater 5 started receiving negotiated discounts from the formal sharing rate in week 2; discounts ranged from 5% in week 2 to 15% in week 7. Theater 20 received no discounts in the first seven weeks before receiving discounts of 5% and 10% in weeks 8 and 9, respectively.

Table 2 expands this illustration to all 22 theaters in our sample showing *A Beautiful Mind* and to two continuation decisions—whether to continue showing a particular reel in a particular theater for an additional week and, if so, whether to show the reel on a dedicated or a shared screen.[14] The top two rows show the distributor's formal sharing rate for the first nine weeks, which decline over time and (for this movie) were the same across all theaters in a given week.[15] The remaining rows report the negotiated discounts (if any) for the weeks the movie was shown in a given theater. Discounts in bold indicate theater-weeks in which *A Beautiful Mind* shared a screen with

Table 2. Negotiated Discounts (%) for *A Beautiful Mind*, February 22, 2002–April 19, 2002

	Formal sharing rate								
	60%		55%		50%		45%		40%
Theater	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
1	5	10	10	15	**10**	5			
2	10	10	10	10	**10**	**15**	**15**		
3	5	0	5	5	10	15	**15**		
4	0	10	5	10	**10**	**15**	**15**		
5	0	5	10	5	5	10	15		
6	0	0	0	10	**5**	0	**15**		
7	0	0	0	0	0	10	10		
8	0	0	0	0	0	5	**15**		
9	0	0	0	0	**0**	0	**15**		
10	0	10	10	15	**10**	0	**15**	**15**	
11	0	5	0	5	0	0	10	**15**	
12	0	0	0	5	**0**	0	**5**	**15**	
13	0	0	0	0	**0**	0	**5**	**15**	**n/c**
14	0	0	0	0	0	0	0	5	n/c
15	0	0	0	0	0	0	0	5	n/c
16	0	0	0	0	0	0	**0**	**5**	**n/c**
17	0	0	0	0	0	0	0	0	n/c
18	0	0	0	0	0	0	0	0	**n/c**
19	0	0	0	0	0	0	0	0	**n/c**
20	0	0	0	0	0	0	0	5	**10**
21	0	0	0	0	**0**	**0**	**0**	**5**	**0**
22	0	0	0	0	0	0	0	0	0

Notes. Data reflect the first reel (i.e., the reel with highest box office revenue) of *A Beautiful Mind* shown in 22 theaters over the first nine weeks since the movie's release. A "negotiated discount" is the difference between the ex ante and ex post share of box office revenues paid to the distributor. Bold font indicates that the reel shared the screen with one or more movies during the week (where reels with fewer than 100 attendees in the week were excluded). The distribution of final run lengths for the 10 theaters still showing *A Beautiful Mind* in the ninth week is 9 weeks ($n = 1$), 10 weeks ($n = 2$), 11 weeks ($n = 1$), 12 weeks ($n = 1$), 13 weeks ($n = 2$), 14 weeks ($n = 2$), and 16 weeks ($n = 1$). The maximum "contracted" run length in our data (i.e., the number of weeks where we have contract data) is 10 weeks; the notation "n/c" denotes that the reel was shown, but we do not have contract data.

at least one other movie during a prime-time slot (i.e., excluding matinees and late-night showings). Table entries of "n/c" (for "no contract") reflect cases where the movie's run extended beyond its original formal contract.

From Table 2, 1 theater stopped showing *A Beautiful Mind* after six weeks, 8 more stopped after seven weeks, 3 more after eight weeks, and 10 more after nine or more weeks. All 22 theaters dedicated a single screen to the movie over its first four weeks; by the fifth week, 9 of the 22 theaters were showing the movie on a shared screen (meaning that *A Beautiful Mind* and another movie were shown on the same screen at different times). The table shows that, for this particular movie, (1) discounts vary across theaters during a given week (even if formal contracts do not), (2) discounts are more likely (and are typically higher) later in the run, and (3) screen sharing is more likely later in the run and is often (but not always) associated with discounts. These three stylized facts are broadly representative of our sample.

2.3. Summary Statistics

We combine Gil's (2013) data on contract terms (both formal and renegotiated sharing rates for reels that are shown) with recently obtained weekly data on attendance, box office revenues for each reel at each theater, and whether the exhibitor showed that reel on a dedicated or a shared screen. Our full sample includes contract and box office data for 435 movies, 5,436 reel-runs, and 19,551 theater-reel-weeks.

The opportunity cost of showing a movie in a theater is substantial only if the theater is capacity constrained (i.e., screens are fully utilized). Whereas the capacity-constraint assumption is reasonable for movies shown in "prime time" (early to late evening, especially on weekends), it is less likely to hold for movies shown in daytime matinees or after midnight. Our data do not include specific show times or screenings per week, so we proxy for prime-time movies by gathering show-time data from local newspapers for twelve theaters in Barcelona and Madrid between January and June 2001. As described in Online Appendix A, a movie is likely to have been shown in prime time if it attracts at least 100 weekly attendees: less than 5% of the movies in our showtime data that were shown during prime time fall below this cutoff, whereas 67% of movies showing only outside of prime time do. We therefore exclude theater-reel-weeks with fewer than 100 weekly attendees from our data, leaving us with 391 movies, 4,931 reel-runs, and 16,398 theater-reel-weeks.[16]

Table 3 presents sample means for selected variables used in our analysis: panel A summarizes data from our entire sample, whereas panel B excludes theater-reel-weeks with weekly attendance less than 100. Sample means are reported separately for three types of reel runs in our data: (1) reels that have a formal revenue-sharing contract for their entire run; (2) reels that begin with a formal contract but switch exactly once to no longer having a contract; and (3) reels whose contracts do not fit the previous categories, including (a) reels that have no formal contract, (b) reels that start with no contract but eventually have a formal contract, and (c) reels that switch more than once between having a contract and not. To analyze ex post renegotiation of formal contracts, we focus on theater-reel-weeks from the first two categories that include a formal contract; we omit reels in category (3) from our dependent variable because of concerns about data quality and representativeness. To measure the exhibitor's opportunity cost, however, we use all available theater-reel-weeks.

As shown in panel B of Table 3, the average formal share of box office revenues going to the distributor is 53.5% and 50.8% in Categories 1 and 2, respectively. Approximately 58% of the theater-reel-weeks in Category 1 were renegotiated, and the average final share for renegotiated reels was 10.5 percentage points lower than the contracted share.[17] Similarly, whereas only 64.4% of theater-reel-weeks in Category 2 had formal contracts, 31.6% of all observations in Category 2 (i.e., 31.6/64.4 = 49% of theater-reel-weeks with formal contracts) were renegotiated, and the average final share for renegotiated reels was 8.2 percentage points lower than the contracted share.[18]

Figure 2 shows the distribution of observed reductions in the distributor share of box office revenues ("discounts") for the 5,476 theater-reel-weeks with observed discounts in Category 1 and Category 2 of Table 2, panel B. Almost all the observed discounts (5,385, or 98.3%) are exactly at 5 percentage points ($n =$ 2,095), 10 percentage points ($n = 1{,}658$), 15 percentage points ($n = 1{,}078$), 20 percentage points ($n = 424$), or 25 percentage points ($n = 130$). Nine reel-weeks (0.16% of the sample) have discounts exceeding 25 percentage points, and another nine had negative discounts of −5 percentage points (i.e., final distributor sharing rates were 5 percentage points larger than the contracted rate). We believe these nine negative discounts are coding errors and so exclude them from the analysis.

Finally, panels A and B in Table 3 also report the fraction of theater-week-reels that are shown on shared (rather than dedicated) screens: about 50% for the full sample in panel A and about 30% after dropping theater-week-reels with attendance below 100 in panel B. As an example of how this number is calculated, if a theater has five screens and six reels, with four reels on dedicated screens and two sharing the final screen, then 33% of the reels are shown on shared screens. Screen sharing is prevalent in our

Table 3. Sample Means for Selected Variables, by Type of Contract

	Category 1: Under contract for entire run	Category 2: Switches once from contract to no contract	Category 3[a]: No contract or mixed contract
Panel A. All theater-reel-weeks			
No. of reels	3,017	715	1,704
No. of reel-weeks	8,332	4,964	6,255
Reel under contract? (%)	100.0	61.8	20.6
Contracted distributor share (reel-weeks with contracts) (%)	53.2	50.8	51.7
Contract renegotiated? (reel-weeks with contracts) (%)	58.9	38.8	46.2
Renegotiated discount (> 0%) (reel-weeks with contracts) (%)	11.1	8.9	12.0
Reel run length (weeks)	4.1	9.4	4.1
Reel shares screen? (%)	54.4	51.3	54.4
Weekly box office (€)	3,448	4,624	3,643
Weekly attendance	821	1,091	851
Panel B. Subsample of theater-reel-weeks with attendance ≥ 100			
No. of reels	2,974	498	1,459
No. of reel-weeks	8,275	3,451	4,672
Reel under contract? (%)	100.0	64.4	16.1
Contracted distributor share (reel-weeks with contracts) (%)	53.5	50.8	52.3
Contract renegotiated? (reel-weeks with contracts) (%)	57.6	31.6	43.3
Renegotiated discount (> 0%) (reel-weeks with contracts) (%)	10.5	8.2	12.0
Reel run length (weeks)	4.0	8.9	5.4
Reel shares screen? (%)	32.2	29.8	31.6
Weekly box office (€)	4,090	5,658	4,400
Weekly attendance	974	1,329	1,026

Notes. Observations correspond to theater-week-reels. *Contract renegotiated?* reflects reels that are under contract where the final ex post price paid to the exhibitor (as a share of box office revenues) exceeds the ex ante contracted share. Weekly box office revenues (in euros) are exclusive of 7% value-added tax.

[a]Category 3 in panel A includes 1,222 reels (3,678 reel-weeks) with no contract during their full reel run and 482 reels (2,577 reel-weeks) with contracts for at least part of their reel run. Category 3 in panel B includes 1,105 reels (3,151 reel-weeks) with no contract during their full reel run, and 354 reels (1,521 reel-weeks) with contracts for at least part of their reel run.

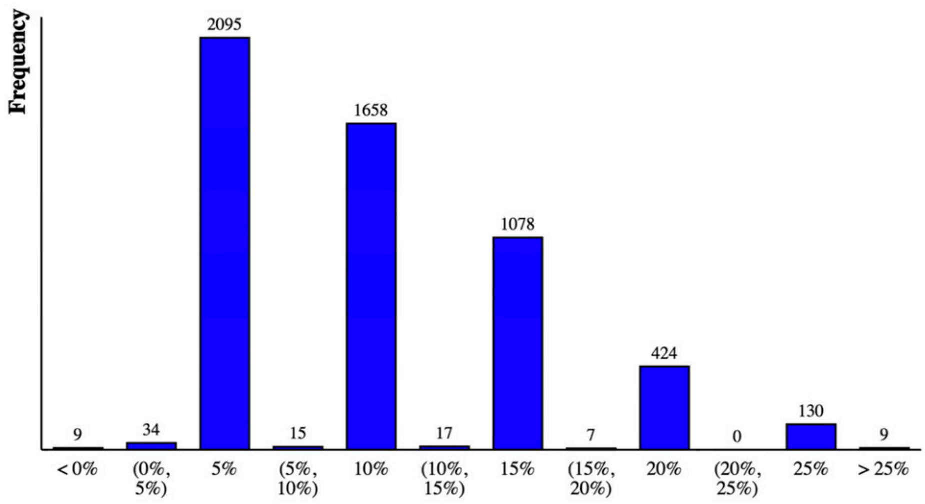
data, which suggests that movies shown on shared screens are an important part of the exhibitor's opportunity cost. Figure 3 shows the distribution of "reels per screen," defined as the number of reels shown in a theater in a given week (after excluding reels attracting fewer than 100 weekly attendees) divided by the number of screens in the theater. Although the number of reels shown equaled the number of screens in 743 of the 1,955 "theater-weeks" of our sample (38%), suggesting that each reel had a dedicated screen, there were more reels than screens in 1,173 (60%) of our movie weeks.[19] The data therefore suggest that exhibitors face a nontrivial opportunity cost from showing movies on dedicated screens in most theater-weeks in our sample.

3. A Simple Framework

This section develops a simple model of formal and relational contracting between an agent (the exhibitor in our setting) and a principal (distributor). As we describe in Sections 1 and 5, we see adaptation as a widespread issue within and between organizations, with relational contracts as an important instrument through which parties achieve adaptation to noncontractible states.

To specialize this general idea to our empirical setting, we first focus on the bilateral relationship between the exhibitor and a given distributor. We assume that at the time of formal contracting for a given movie, there is uncertainty about the exhibitor's eventual opportunity cost of showing that movie (i.e., uncertainty about the revenues the exhibitor could earn by showing a movie from an unmodeled second distributor). We also assume that after formal contracting for the given movie, the distributor takes a costly, observable, noncontractible action that increases the total revenue from showing that movie. In the model, this action precludes the distributor from eliminating agency costs by "selling the reel" to the exhibitor; we interpret this action as advertising for the movie or as refraining from also showing the movie with an unmodeled second exhibitor in the same market.[20] We model this action as taking place before the distributor decides whether to show the movie, although in practice, the distributor promotes the movie both before and after the exhibitor decides which movies to show. After uncertainty for a given movie is publicly resolved, the exhibitor decides whether to show that movie. Maximizing distributor–exhibitor surplus in this bilateral relationship requires that (i) the distributor take the value-increasing action and (ii) the exhibitor show the movie if and only if its box office revenue exceeds its opportunity cost. Note that

Figure 2. (Color online) Frequency Distribution for Observed Discounts

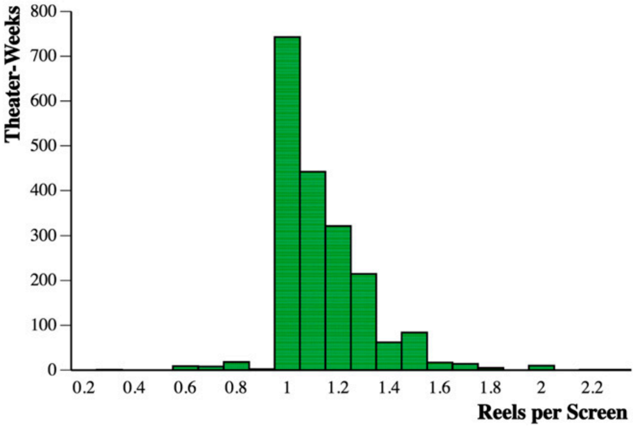


Note. Depicted is the frequency distribution of observed discounts for 5,476 renegotiated theater-reel-weeks with formal contracts throughout their runs or moving from formal contracts to no contracts during their runs.

maximizing bilateral surplus (what we call "efficient adaptation") does not necessarily maximize the joint surplus of the exhibitor and *all* the distributors, a point we discuss further in Section 4.4.

If the distributor and exhibitor were sufficiently patient, they could maximize their joint surplus without any formal contract, using relational payments from the distributor to the exhibitor if the exhibitor takes efficient decisions. We therefore focus on relational contracts when the parties have intermediate patience. Optimal governance then combines formal and relational contracting: *after* a given movie has finished its run, the parties may renegotiate the

Figure 3. (Color online) Distribution of Reels per Screen in 1,955 Theater-Weeks



Notes. Depicted is the distribution of "reels per screen," defined as the number of reels shown in a theater in a given week, after excluding reels garnering fewer than 100 weekly attendees. Depicted distribution excludes the "preopening" weekend of a 16-screen theater occurring in the middle of our sample period, where only 2 of 16 screens (0.125 reels per screen) were utilized.

formal contract so that the exhibitor earns a "discount" relative to the formal terms. This discount compensates the exhibitor for showing the distributor's movie more than would have been induced by the formal contract alone and thereby induces the exhibitor to continue some movies that she would have instead dropped because of a high opportunity cost. The distributor can pay smaller relational discounts if he offers a generous formal contract, but in that case, he is less willing to take the costly action that increases box office revenue.

Our relational-contracting model in Section 3.1 considers a single distributor and assumes that the exhibitor's opportunity cost is exogenous. In Section 3.2, we discuss how this opportunity cost arises from competition between distributors, as in our empirical setting. This broader discussion considers how distributors might compete with one another to secure an additional showing of a given movie in a given theater. The opportunity cost of showing a focal movie one additional time is then the largest payment the exhibitor would earn from showing a different movie, where this payment includes both the formally contracted revenue share and any relational discount that the distributor of that alternative movie would have paid for a showing. This discussion, and most of our empirical analysis, assumes that all distributors are willing to pay the entire difference between their movies' box office revenues and the share of those revenues that the formal contract promises to the exhibitor. This assumption is reasonable if all distributors have "strong relationships" with the exhibitor, a point we discuss further in Sections 3.2 and 4.4.

In principle, one could imagine a model that combines relational and formal contracts with competition among multiple distributors. We do not attempt such a model. Instead, we take from our one-distributor model an understanding of why the parties might write a formal contract ex ante only to renegotiate it after the movie has finished its run, and we then link this two-player model to our richer empirical setting.

3.1. Relational Adaptation Supported by Formal Contracting

We consider a repeated game between two players: an exhibitor (E) and a distributor (D), each with discount rate r. The distributor has a movie that would produce box office revenue v if shown by the exhibitor. The timing of the stage game is as follows: (1) D offers a formal (i.e., court-enforceable) revenue-sharing contract that consists of a salary $s \in \mathbb{R}$ and a sharing rate $\beta \in [0,1]$, meaning the exhibitor earns a fraction β of the movie's realized box office; (2) D publicly chooses $a \in \{0,1\}$, where a is observable but not contractible, and $a = 0$ generates a private benefit to the distributor of $K > 0$; (3) E's outside option, $x \in \mathbb{R}$, is publicly drawn from distribution $F(x)$ with density $f(x)$; (4) E publicly chooses either to show D's movie ($d = 1$) or to take her outside option ($d = 0$); and (5) D can pay E, or vice versa, with $b \in \mathbb{R}$ denoting the net payment to E.

Payoffs are $ad(1 - \beta)v + (1 - a)K - s - b$ for the distributor and $adßv + (1 - d)x + s + b$ for the exhibitor. Note that the movie had no box office revenue if either (a) the exhibitor does not show the movie ($d = 0$) or (ii) the distributor does not take the costly action ($a = 0$). The former is immediate; think of the latter as a simple model of either a lack of marketing effort by the distributor or the distributor's decision to show another reel of this movie at an unmodeled exhibitor that competes with the modeled exhibitor. Assuming that $\mathrm{E}[\max\{v,x\}] > \mathrm{E}(x) + K$, the decision rule that maximizes bilateral surplus $(1 - d)x + dav$ sets $a = 1$ in each period, with $d = 1$ if and only if $x \le v$.[21]

The goal of this model is to understand why the parties might write a formal contract ex ante only to renegotiate it after the exhibitor makes a decision. Several potential enrichments might add realism but are unlikely to overturn this message. First, the exhibitor actually has many decisions besides whether to show a movie—such as how often, at what times, on which screen, with what alternative movies showing on other screens at the same times, and so on. Second, the movie's box office revenue is, of course, both uncertain and a richer function of both the exhibitor's and distributor's actions than is reflected in the binary decisions d and a. Third, both parties may have payoffs beyond their share of the movie's revenues, such as from concessions for the exhibitor and merchandising for the distributor.

Turning from interpretation to analysis, the equilibrium is simple in the one-shot version of this repeated game. Neither party will make a payment other than $b = 0$, so the exhibitor will show the movie if and only if doing so is more profitable than taking her outside option, $\beta av \ge x$. The exhibitor chooses d to maximize bilateral surplus only if $\beta = 1$, but in that case, the distributor would choose $a = 0$. Therefore, either $a = 0$ or the distributor's optimal formal contract in the one-shot game is $\beta^{OS} < 1$. The latter holds if and only if there exists a $\beta \in [0, 1]$ such that

$$\int_0^{\beta v} (1 - \beta)vf(x)dx \ge K,$$

in which case the equilibrium share β^{OS} equals the largest β that satisfies this inequality. The up-front payment s will then hold the exhibitor to her outside option, $E^{OS} \equiv E[x]$, whereas the distributor will earn surplus $D^{OS} = \int_0^{\beta^{OS}v}(v - x)f(x)dx - K$.

We now turn to the repeated game. Because adaptation decisions do not maximize bilateral surplus in the one-shot game, relational contracting may improve bilateral surplus in the repeated game. Specifically, if a relational contract can deliver appropriate payments conditional on x and d, it can induce the exhibitor to show the movie for at least some x satisfying $\beta v < x < v$. Consistent with our empirical setting, such payments ($b > 0$) are made after the exhibitor chooses d.

Given our assumption that players have deep pockets and actions are observable, we focus on optimal stationary contracts (i.e., on the equilibrium path, players choose the same actions each period), which are optimal by an argument adapted from Levin (2003). We also restrict attention to equilibria that use Nash threats (i.e., following a deviation, the parties revert to the equilibrium of the one-shot game described above).[22]

Consider the following candidate equilibrium. On the equilibrium path, in each period, the distributor offers a formal contract β, described below; the distributor chooses $a = 1$, the exhibitor observes x and chooses $d = 1$ if $x \le \bar{x}$ for some $\bar{x} \le v$ (and $d = 0$ otherwise), and the distributor pays the exhibitor $b(x) \ge 0$ if $x \le \bar{x}$ and $d = 1$ (and $b = 0$ otherwise). Define V^D and V^E as the expected payoffs to the distributor and exhibitor, respectively, from this equilibrium. Results from Levin (2003) can be adapted to prove that there exists a relational contract in which $V^E = E^{OS} = E[x]$ that is optimal in this class of equilibria with Nash threats. In such an equilibrium, the exhibitor is unwilling to make any relational payment, so $b \ge 0$ for all x. After any deviation, the parties receive payoffs D^{OS} and E^{OS} in all future periods.

This candidate equilibrium must satisfy three incentive constraints. First, the exhibitor must be willing to choose d=1 whenever $x \le \bar{x}$: for such x,

$$\beta v + b(x) \ge x. \tag{1}$$

Second, the distributor must be willing to pay $b(x)$: for all $x \le \bar{x}$,

$$-b(x) + \frac{1}{r}V^D \ge \frac{1}{r}D^{OS}. \tag{2}$$

Define $S^* \equiv V^D + V^E$ and $S^{OS} \equiv D^{OS} + E^{OS}$ as the total surplus in this relational contract and in the one-shot equilibrium, respectively. Then combining (1) and (2) implies that, in the relational contract that maximizes total surplus,

$$\bar{x} = \min\left\{v, \beta v + \frac{1}{r}(S^* - S^{OS})\right\}. \tag{3}$$

Finally, the distributor must be willing to choose $a = 1$:

$$K \le \int_0^{\beta v} (1-\beta)vf(x)dx + \int_{\beta v}^{\bar{x}} (v - x)f(x)dx + \frac{1}{r}(S^* - S^{OS}). \tag{4}$$

The smallest relational discount that satisfies (1) is $b(x) = \max\{0, x - \beta v\}$, which maximally relaxes (2) and (4). In the optimal relational contract, β^* equals the largest β that satisfies (4), because $\bar{x}$ and hence total surplus are increasing in β. For our empirical predictions, it suffices to note that S^*, $\bar{x}$, and $b(\bar{x})$ are (weakly) increasing in $1/r$.

Our candidate equilibrium matches the stylized facts in our empirical setting and is optimal among those that rely on Nash threats, but other relational contracts perform equally well. For example, the exhibitor might earn rent in the repeated relationship, in which case the formal contract might occasionally be renegotiated in favor of the distributor (i.e., $b < 0$), which we essentially never observe in our data. Alternatively, the distributor might compensate the exhibitor with attractive future contracts rather than discounts, but discounts occur frequently in our data.[23]

Some enrichments of this model could threaten our intended message and hence need to be discussed. In particular, the timing above assumes that neither x nor d is contractible. In reality, both x and d probably are contractible—but at a cost. If d were contractible but x not, then in our simple model, a could be perfectly inferred from box office revenue whenever $d = 1$, and so formal contracts alone could induce the exhibitor to take decisions that maximize bilateral surplus. Similarly, if x were contractible, then the sharing rule $\beta(x) = x/v$ would exactly compensate the exhibitor for her realized opportunity cost, which would again maximize bilateral surplus without any need for relational contracting. However, these arguments imagine d or x to be *costlessly* contractible. If the distributor can instead contract on d or x at some cost, then the spirit of our results holds so long as this cost is not too small: the parties use relational discounts to avoid writing a costly formal contract.[24]

3.2. Connecting the Model to the Data

Our relational-contracting model suggests that we should observe a discount from the formal contract when the exhibitor's outside option is large relative to her contracted box office revenue from the distributor's movie. We enrich this intuition in two ways to apply it to our empirical setting. First, we connect the exhibitor's opportunity cost to *other* distributors' (relational) contracts with the exhibitor. Second, we consider the adaptation decisions that might be influenced by the relational contract: not only which movies will be shown in the theater but also which movies will be shown on which screens at which time.

A typical theater has multiple screens, each of which has multiple showings. A given reel can be shown on at most one screen at a time. Therefore, the exhibitor must solve the following adaptation problem: Given the number of showings in the day and the number of times each reel can be shown, what allocation of reels to showings maximizes profit? In this problem, the opportunity cost of showing a reel one additional time equals the revenue the exhibitor would earn from the next best reel that could be shown during that time. Reels that are already on dedicated screens cannot be shown any additional times, so this next best reel is either a *dropped* reel, which would otherwise receive zero showings, or a *shared* reel, which would otherwise share a screen with another movie.

If the exhibitor (counterfactually) shows a dropped movie or shows a shared movie on a dedicated screen, she would earn (i) the revenue-sharing payment specified in that movie's formal contract, as well as (ii) any relational payment that the movie's distributor would be willing to pay for an additional showing. Although we do not observe the counterfactual relational payment, the analysis in Section 3.1 suggests that this relational payment should be no larger than the difference between *the total box office revenue generated by an additional showing of that movie* and *the exhibitor's formally contracted share of that box office revenue.* Therefore, the exhibitor's payoff from showing a dropped or shared movie should be no more than the *total* box office revenue generated by that showing. Most of our empirical analysis therefore uses an estimate of the total box office revenue generated by one more showing of the best dropped or shared movie as a proxy for x. Ignoring the predictable depreciation in box office revenues from movies over time (or those moved from dedicated to shared screens), our proxy is most accurate if each distributor had a strong enough relationship with the exhibitor to credibly promise substantial relational discounts. If not all distributors have strong relationships with the exhibitor, then our proxy for opportunity cost is imperfect, but even in that case, x should be positively correlated with the best alternative movie's total box office revenue. We explore heterogeneity in the distributors' relationships with the exhibitor further in Section 4.4.[25]

The above discussion motivates our three empirical predictions. First, conditional on a movie being continued, discounts given to the exhibitor should be larger and more likely when her opportunity cost x of showing the focal movie is large. This prediction is motivated by the expression $b(x) = \max\{0, x - \beta v\}$ derived from (1). When $x < \beta v$, the exhibitor will continue the movie (i.e., set $d = 1$) based on the formal contract alone without ex post renegotiation. When $\beta v < x \leq \bar{x}$, the movie will be continued only if the exhibitor anticipates an ex post discount no less than $x - \beta v$. When $x > \bar{x}$, the movie is discontinued, and no discount is paid. Therefore, conditional on continuation, both the magnitude and the frequency of negotiation of the discount are increasing in x.

Our second prediction is that discounts paid after a movie finishes its run induce relational adaptation during the run provided that $\beta v < x \leq \bar{x}$. In particular, whereas the exhibitor will continue showing movies when $x < \beta v$ without such a discount, we predict that the exhibitor will continue showing a movie when $x > \beta v$ only if she anticipates receiving a compensatory future discount.

Our third prediction derives from a comparative-static calculation involving the continuation surplus in the relational contract, $1/r(S^* - S^{OS})$. Holding the formal revenue βv fixed and below x, the probability that a movie is continued is increasing in continuation surplus; that is, $\Pr\{\rho < x < \bar{x} | \beta v = \rho\}$ is increasing in $(1/r)(S^* - S^{OS})$, holding all else fixed. To the extent that different distributors have heterogeneous values for their relationship with the exhibitor, we should expect that, *conditional* on βv distributors who value their relationships more are more likely to have their movies continued. This effect should be particularly large for movies that would not be continued based on the formal contract alone: $\beta v < x$. Moreover, because the largest equilibrium discount equals $b(\bar{x}) = (1/r)(S^* - S^{OS})$, the *maximum* discount offered by a distributor should be positively related to the continuation value of that distributor's relationship with the exhibitor.

To conclude this section, we revisit the alternative argument that ex post renegotiation facilitates risk sharing or compensates for unexpectedly poor performance, as in Filson et al. (2005), Gil and Lafontaine (2012), and Gil (2013). These arguments suggest that discounts should depend on the focal movie's performance (v). We offer an alternative interpretation of these renegotiations in terms of relational adaptation. In particular, we predict that discounts should (i) also respond to the opportunity cost of continuing a movie rather than its next-best alternative in order to (ii) influence the exhibitor's screening decisions. Thus, in contrast to existing work, our empirical analysis focuses on the relationship between discounts (b), opportunity costs (x), and continuation decisions (d).

4. The Determinants of Relational Renegotiation

In this section, we provide empirical evidence supporting the three predictions discussed in Section 3. First, conditional on a movie being continued, discounts are larger and more frequent when the exhibitor's opportunity cost of showing the focal movie is larger. Second, anticipated future discounts influence current decisions about whether to continue showing a reel on a dedicated screen or at all. Third, distributors with higher continuation surpluses offer larger discounts and are more likely to have their movies continued.

4.1. Prediction 1A: Opportunity Costs Affect Renegotiations

Our first prediction has two testable components: conditional on a movie being continued, both (a) the probability of renegotiation and (b) the expected discount conditional on renegotiation increase in the opportunity cost x. To test (a), recall from Section 3.1 that, conditional on a movie being continued, renegotiation occurs if and only if $\beta v < x$. We can measure βv using box office revenues and contractual sharing rates. To proxy for x, we follow the discussion from Section 3.2 and use (i) the anticipated box office revenues the best dropped reel would have earned had it not been dropped, and (ii) the *incremental* anticipated box office revenues the best shared reel would have earned had it been shown on a dedicated screen (i.e., in all prime-time slots). Of course, we cannot directly observe these opportunity costs. We use the best dropped reel's revenues from the previous week to proxy for (i), which is likely an overestimate of the opportunity cost because revenues predictably decrease from one week to the next. Similarly, we proxy for (ii) with the reel's observed revenues from the current week; we also likely overestimate this opportunity cost if movies exhibit decreasing marginal revenue from additional showings.

We test whether renegotiation is correlated with opportunity cost by estimating the following linear probability model:

$$\Pr(Renegotiate_{itw}) = \alpha_1 D_{itw}^{\text{Best Dropped}} + \alpha_2 D_{itw}^{\text{Best Shared}} + \gamma_{iw} + \eta_t + \varepsilon_{itw}, \quad (5)$$

where $Renegotiate_{itw}$ is an indicator variable equal to 1 if the formal contract for reel i in theater t in week w is renegotiated at the end of its run, $D_{itw}^{\text{Best Dropped}}$ is an indicator variable equal to 1 if the box office revenue of the best dropped reel from the prior week exceeds the contracted revenue from the focal reel, and $D_{itw}^{\text{Best Shared}}$ is an indicator variable equal to 1 if the revenue of the best shared reel in the current week exceeds the contracted revenue from the focal reel.

Our estimation compares two reels of the same movie at different theaters in the same week. To that end, we include reel-week fixed effects, γ_{iw}, to control for differences between a movie's first reel in a given theater (defined as the reel with the highest revenue) and additional reels of the same movie, as well as any variables that affect all reels of a given movie within a given week, such as its quality, the timing of its release, or predictable depreciation in box office revenue over time. We also include theater fixed effects, η_t, to control for time-invariant theater-specific factors (such as location, managerial talent, or other factors). The identifying variation thus comes not only from variation in the focal movie's box office revenues across theaters during the same week but also from variation in opportunity costs across theaters within a week, because different theaters will have different best dropped and best shared reels.[26]

To illustrate the intuition behind our fixed-effects approach, Table 4 returns (for the last time) to *A Beautiful Mind*, now focusing on the seventh week after the movie's release. For each theater showing this movie this week, the numbered columns of the table show (1) box office revenue for this movie this week (or the highest-grossing reel if the movie was played on multiple screens), (2) our proxy for revenues from this week's best dropped movie, (3) our proxy for revenues from this week's best shared movie, and (4) the renegotiated discount, if any, for this movie this week. The observations are sorted by box office revenue for the focal movie (i.e., *A Beautiful Mind*); theater 1 is not included because (as evident from Table 2) the movie was discontinued in that theater after week 6.

Even within this single movie-week, Table 4 shows substantial variation across theaters in box office revenues, which range from €441 to €13,172. It is important to note that opportunity costs vary as well: revenues for the best dropped movie this week range from €701 to €6,531 (where missing values, denoted by em dashes, reflect theaters with no dropped reels from the prior week), and revenues for the best shared movie this week range from €1,480 to €15,300 (where missing values, denoted by em dashes, reflect theaters that showed all reels on dedicated screens during the

Table 4. Box Office Revenues, (Proxies for) Opportunity Costs, and Renegotiated Discounts for Week 7 of *A Beautiful Mind*

Theater	Box office revenues for *A Beautiful Mind* (€)	Box office revenues for best reel in prior week dropped in current week (€)	Box office revenues for best shared reel in current week (€)	Renegotiated discount (%)
	(1)	(2)	(3)	(4)
3	441	1,330	2,942	15
2	873	1,403	2,835	15
4	1,773	2,267	3,596	15
9	2,041	701	8,958	15
8	2,262	1,450	3,832	15
12	2,306	—	3,232	5
10	2,360	3,700	2,094	15
11	2,514	1,868	6,658	10
7	2,631	1,513	1,480	10
5	2,636	3,352	—	15
6	2,740	4,845	2,754	15
13	3,068	4,308	4,348	5
16	4,109	4,204	4,894	0
14	5,006	2,404	3,298	0
20	5,110	4,536	4,258	0
17	5,487	4,232	7,595	0
15	5,540	1,860	5,199	0
19	5,844	6,531	5,441	0
18	7,926	3,096	7,174	0
21	8,500	5,824	15,300	0
22	13,172	1,018	—	0

current week). The incidence and size of renegotiated discounts vary as well: 12 theaters had discounts whereas 9 did not, and these 12 discounts ranged from 5% to 15%.

Consider theaters 12 and 10. They had nearly identical box office revenues in week 7—€2,306 for theater 12 and €2,360 for theater 10. But, whereas theater 10's best dropped reel had prior-week revenues of €3,700 (suggesting a high opportunity cost of showing *A Beautiful Mind* for another week), theater 12 did not drop any reels from the prior week, it thus faced a lower opportunity cost of continuing *A Beautiful Mind*. We therefore predict that theater 10 should receive a higher discount, and the data are consistent with our prediction—discounts are 15% for theater 10 and 5% for theater 12.

Table 5 reports results from estimating (5). Columns (1) and (2) include our proxies for the best dropped and best shared reels, respectively, and column (3) includes both measures of x as regressors. The sample size varies across columns because not all theater-reel-weeks have best dropped or best shared reels. We run linear probability models to accommodate the large number of fixed effects in our regressions. We cluster standard errors at the theater-week and reel levels because continuation and screen-sharing decisions are likely related (a) across all reels showing in a given theater during a week and (b) across time for a given reel.

Consistent with our first prediction, the probability of renegotiation is positively related to our indicator variables in all three regressions. From column (3) of Table 5, we find that, on average, a reel is 9.8 percentage points more likely to have its contract renegotiated if revenues of the best dropped movie in the previous week are larger than the exhibitor's revenues in the current week for the focal movie. Similarly, the likelihood of renegotiation increases by 2.9 percentage points when the revenues of the best shared movie in the current week are higher than the focal movie's current revenues in the given theater.[27]

The discussion in Section 3.2 assumes that each movie competes for screen space with every other movie. In practice, reels that are owned by the same parties might not compete with one another. However, "ownership" is a tricky concept in our setting, because both a distributor and a group of studios typically have financial stakes in a given movie. Consequently, even movies that are attached to the same distributor might compete for screen space if they are produced by different groups of studios. The one case in which there clearly should be no competition occurs when the exhibitor chooses between two reels of the same movie, because (by definition) these reels share distributors and studios. In Online Appendix B, Table A2 reestimates Table 5 after allowing the coefficients on our measures of opportunity cost to vary based on whether the focal and best dropped (or best shared) reels are of the same movie. Supporting Table 5, the coefficients on best dropped and best shared reels corresponding to different movies remain positive and significant. The analogous coefficients are less significant (or insignificant) when the best dropped and best shared reels are additional reels of the focal movie.[28]

4.2. Prediction 1B: Opportunity Costs Affect Discounts

The smallest *percentage* discount satisfying Equation (1) is

$$\frac{b}{v} = \max\left\{0, \frac{x}{v} - \beta\right\}. \tag{6}$$

Therefore, conditional on $b > 0$, the observed percentage discount is positively related to the ratio of

Table 5. Prediction 1A: Are Reels with Larger Opportunity Costs More Likely to Be Renegotiated?

	Dependent variable: *Renegotiation* (1 if contract is renegotiated, 0 otherwise)		
	(1)	(2)	(3)
Dummy if $(\textit{Best Dropped Reel})_{t\text{-}1} > (\beta \times \textit{Revenues}_t)$	0.1033***		0.0983***
	(6.97)		(6.62)
Dummy if $(\textit{Best Shared Reel})_t > (\beta \times \textit{Revenues}_t)$		0.0402***	0.0292**
		(2.93)	(2.13)
Theater fixed effects?	Yes	Yes	Yes
Reel-week fixed effects?	Yes	Yes	Yes
R^2	0.7053	0.7066	0.7152
Sample size	9,618	8,428	7,798

Notes. The *t*-statistics in parentheses; Standard errors are clustered by theater-week and reel. Observations correspond to theater-week-reels. The dependent variable *Renegotiation* is a (0,1) dummy variable equal to 1 for reel-weeks where the final ex post price paid to the exhibitor (as a share of box office revenues) exceeds the ex ante contracted share.

** and ***Significance at the 0.05 and 0.01 levels, respectively.

opportunity cost to box office revenue, x/v, and negatively related to the exhibitor's formal share, β. We test whether the percentage discount is affected by opportunity costs by estimating the following regression:

$$\frac{b_{itw}}{V_{itw}} = \alpha_1 \frac{X_{itw}^{\text{Best Dropped}}}{V_{itw}} + \alpha_2 \frac{X_{itw}^{\text{Best Shared}}}{V_{itw}} + \alpha_3 \beta_{itw} + \gamma_{itw} + \eta_t + \varepsilon_{itw}, \quad (7)$$

where b_{itw}/v_{itw} is the difference between the final share and contracted share to the exhibitor, and the independent variables are (1) measures of x_{itw}/v_{itw}, where we expect positive signs, and (2) the exhibitor's contracted share, β_{itw}, where we expect a negative sign. As in (5), the regression includes both reel-week and theater fixed effects.

Table 6 reports results from ordinary least squares estimating (7). Analogous to Table 5, column (1) excludes $x_{itw}^{\text{Best Shared}}/v_{itw}$, column (2) excludes $x_{itw}^{\text{Best Dropped}}/v_{itw}$, and column (3) includes both of these measures of opportunity costs. We again cluster standard errors at the theater-week and reel levels.

Consistent with (6), the magnitude of the discount is positively and significantly related to both opportunity-cost ratios in all three regressions, and it is negatively and significantly related to the exhibitor's contracted share. Results from column (3) in Table 6 show that a 10-fold increase in the ratio between revenues of the best dropped movie and the focal movie is associated with an increase in discount of 4.1 percentage points. Similarly, a 10-fold increase in the ratio between revenues of the best shared movie and the focal movie is associated with an increase in discount of 1.5 percentage points. Finally, a decrease of 5% in the formal sharing rate of a movie in a given week is associated with an increase in discount of 3.1 percentage points.[29] Because our proxy for opportunity costs almost certainly suffers from measurement error, these coefficients likely understate the true magnitude of the association.

Similar to the discussion at the end of Section 4.1, Table A3 in Online Appendix B reestimates the results in Table 6 after allowing the coefficients for the best dropped and best shared independent variables to vary based on whether the focal and best dropped (or best shared) reels were multiple reels of the same movie. Although the coefficients on best dropped and best shared reels remain positive and significant for reels different from the focal movies, the coefficients are weakly significant or insignificant when the best dropped and best shared reels are additional reels of the focal movie.[30]

4.3. Prediction 2: Future Discounts Affect Current Continuations

In our model, a reel is continued only if $x \le \bar{x}$. If $x > \beta v$ as well, then the exhibitor would discontinue the reel in the absence of an expected relational bonus, so the distributor must pay $b > 0$. In that case, the expectation of the future discount influences the exhibitor's continuation decision.

Testing the hypothesis that expected discounts affect continuation decisions is challenging for two

Table 6. Prediction 1B: Do Reels with Larger Outside Options Have Larger Negotiated Discounts?

	Dependent variable: *Ex post final share less ex ante contracted share*		
	(1)	(2)	(3)
Ratio of (*Best Dropped Reel*)$_{t\text{-}1}$ to (*Revenues*)$_t$	0.00555***		0.00408***
	(5.63)		(3.87)
Ratio of (*Best Shared Reel*)$_t$ to (*Revenues*)$_t$		0.00224***	0.00147***
		(6.42)	(3.66)
Contracted Share (β)	−0.5672***	−0.5995***	−0.6192***
	(−9.61)	(−9.97)	(−10.45)
Theater fixed effects?	Yes	Yes	Yes
Reel-week fixed effects?	Yes	Yes	Yes
R^2	0.7961	0.8002	0.8074
Sample size	9,618	8,428	7,798

Notes. The *t*-statistics are shown in parentheses. Standard errors are clustered by theater-week and reel. Observations correspond to theater-week-reels. The dependent variable is the difference between the final ex post price paid to the exhibitor and the ex ante contracted share. The contracted share (β) is the share of box office revenues contractually guaranteed to the exhibitor. *Best Dropped Reel* is the highest box office revenues in the prior week for reels shown in week $t-1$ but not in week t. *Best Shared Reel* is the highest box office revenues in the current week of any reel shown in the current week (except the focal reel, if that reel were shared in the current week).

***Significance at the 0.01 level.

reasons. First, we do not observe discounts for discontinued movies. Second, we cannot use our proxies for x (namely, the box office revenues of the best dropped and best shared reels) in analyzing continuation decisions, because those proxies are the result of the continuation decisions being analyzed.

Because we do not observe discounts for discontinued movies, we use a two-stage approach to test indirectly the hypothesis that future discounts affect current decisions. In the first stage, we use our full sample of continued and discontinued reels to estimate a reel's continuation probability as a function of a *Reel at Risk* variable that equals 1 if a reel is among the n worst-performing reels in a given week, where n is the number of new reels released at the theater in the following week. *Reel at Risk* contains information about both x and v and can be interpreted as a proxy for the event $v \leq x$ that is likely equal to 1 when x is relatively large and, in particular, when $x > \beta v$. Hence, a reel at risk is less likely to be continued but, conditional on continuing, is more likely to be accompanied by a discount. That is, if we restrict attention to those reels that are actually continued, then the fitted values from our first stage should be negatively correlated with the frequency and magnitude of observed discounts.

The second stage of our estimation tests this prediction based (by necessity) on a smaller sample of reels that are actually continued. Restricting attention to continued reels, we show that discounts are both more frequent and larger if the exhibitor continues a reel that our first stage predicted was likely to be dropped. In short, *expected future renegotiations appear to influence adaptation decisions, in the sense that "unexpectedly" continued movies are more likely to be renegotiated*.

This logic also applies to the exhibitor's decision to continue a movie on a dedicated rather than a shared screen. In that case, we define a reel as "at risk" if it is one of the n reels with the lowest revenue among those reels that are shown on dedicated screens. Now the first stage uses the sample of all reels that are (a) shown on dedicated screens and (b) continued on either dedicated or shared screens to estimate the probability that a given reel is continued on a dedicated screen rather than a shared screen, and the second stage compares this estimated likelihood to the observed discount for those reels that are continued on a dedicated screen (where the second stage is again necessarily estimated on a smaller sample of movies continued on dedicated screens).

Table 7 reports first-stage estimates from regressions of continuation decisions on *Reel at Risk*, the number of new releases coming to the theater in week $t + 1$ (which we expect to be negatively correlated with continuation, because more new incoming reels leaves fewer screens for older reels), and the reel's revenues in week t. Columns (1) and (3) report logistic regressions that include theater fixed effects, and columns (2) and (4) report linear probability models that include both theater and reel-week fixed effects. Standard errors for all regressions are clustered by theater-week and reels. Columns (1) and (2) define a "reel at risk" as one of the n lowest-revenue reels in a week and consider the decision to either continue a reel or drop it entirely. Columns (3) and (4) consider the decision to continue a reel on a dedicated or a shared screen and so restrict attention to reels that are shown at least once in week $t + 1$. Consistent with the argument above, a reel is less likely to be continued for another week (or continued on a dedicated screen) if that reel is at risk. The expected continuation probability is increasing in current-period revenues and decreasing in the number of new releases coming to the theater in week $t + 1$.

The second stage of our estimation uses the estimates from the linear probability models in columns (2) and (4) of Table 7 to analyze whether future renegotiations are related to current continuation decisions.[31] Panel A of Table 8 groups theater-reel-weeks into quintiles based on predicted continuation probabilities from column (2) of Table 7 and gives the average frequency and magnitude of subsequent renegotiations for each group.[32] Recall that panel A of Table 8 includes only those theater-reel-weeks for which the reel is shown in both week t and week $t + 1$. Therefore, observations in the lowest quintile of panel A should be interpreted as reels that were continued in spite of being predicted not to be continued, whereas observations in the highest quintile are reels that were expected to be continued and were, indeed, continued.

As is evident from panel A of Table 8, the frequency of renegotiation, the average discount (including theater-reel-weeks with no discount), and the average positive discount (excluding theater-reel-weeks with no discount) all decline monotonically across quintiles. The entries in each column are all significantly different from each other at the 1% level or better, with only two exceptions: the first and second quintiles in column (1) are significantly different from each other at the 5% level, and the third and fourth quintiles in column (3) are significantly different from each other at the 10% level. We interpret these results as evidence that the exhibitor's decision to continue a reel that we predicted to be discontinued is correlated with larger and more frequent ex post discounts for that reel in that week.

Panel B of Table 8 performs the same exercise as in panel A, except that it uses column (4) of Table 7 to group theater-reel-weeks into quintiles based on the predicted likelihood that a movie is shown on a

Table 7. Prediction 2: Are Movies That Are "Unexpectedly Continued" Renegotiated? (Stage 1)

	Dependent variable: *Reel shown in week t continued in week t* + 1		Dependent variable: *Reel shown on dedicated screen in week t continues on unshared screen in t* + 1	
	(1) Logistic	(2) Linear	(3) Logistic	(4) Linear
ln(1 + *New Releases in week t* + 1)	−1.041***	−0.0918***	−1.246***	−0.1330***
	(−7.54)	(−5.87)	(−5.73)	(−5.72)
ln(*Revenues in week t*)	1.952***	0.2028***	1.221***	0.1564***
	(15.63)	(16.39)	(7.14)	(7.35)
Reel is among the n reels with lowest revenues (where *n* is the number of new releases in week *t* + 1)	−0.8137***	−0.1966***		
	(−7.39)	(−11.37)		
Reel is among the n reels on dedicated screens with lowest revenues (where *n* is the number of new releases in week *t* + 1)			−1.536***	−0.2037***
			(−12.62)	(−10.16)
Theater fixed effects?	Yes	Yes	Yes	Yes
Reel-week fixed effects?	No	Yes	No	Yes
R^2 (or pseudo-R^2)	0.3674	0.6560	0.2502	0.5177
Sample size	10,498	10,498	6,036	6,036

Notes. Dependent variables are (0,1) dummies indicating that the reel was continued (columns (1) and (2)) or continued on a dedicated screen (columns (3) and (4)). The *t*-statistics (or asymptotic *t*-statistics) are shown in parentheses. Standard errors are clustered by theater-week and reel. The sample in columns (1) and (2) consists of all reels with formal contracts throughout their runs or moving from formal contracts to no contracts during their runs. The sample in columns (3) and (4) consists of the same reels in columns (1) and (2) conditional on (a) shown during both week *t* and week *t* + 1 and (b) shown on an dedicated screen in week *t*.

***Significance at the 0.01 level.

dedicated rather than a shared screen. Analogous to panel A, panel B includes only theater-reel-weeks in which the reel is shown on a dedicated screen in both weeks t and $t+1$. Observations in the lowest quintile are thus interpreted as reels that, as predicted in the first stage, would share a screen but were instead continued on a dedicated screen, whereas observations in the highest quintile are reels that, as estimated in the first stage, would likely continue on a dedicated screen and were continued on a dedicated screen.

As in panel A of Table 8, panel B shows that the average discount (column (2)) declines monotonically across quintiles. The frequency of renegotiation (column (1)) also declines, except for a slight increase between the third and fourth quintiles, whereas the average positive discounts (i.e., after excluding zeros) in column (3) generally decline as well after the third quintile. The quantitative results in panel B are not as strong as in panel A: in columns (1) and (2), the first, second, and third quintiles are significantly different from the fourth and fifth quintiles at the 5% level or better. In addition, quintile 4 is significantly different from quintile 5 at the 10% level in column (1), whereas quintile 3 is significantly different from quintile 5 at the 2% level in column (2); no other pairs are significantly different. In column (3), the first, second, and third quintiles are significantly different from the fourth and fifth quintiles at the 10% level or better; no other pairs are significantly different. The results in panel B therefore provide additional (but weaker) evidence that future renegotiation outcomes are related to current continuation decisions—in this case, the decision to continue showing a reel on a dedicated screen.

The quintiles in Table 8 are computed from estimated coefficients in Table 7; this introduces an additional source of estimation errors. To address this concern, we recalculate the standard errors for each quintile using a jackknife procedure, where we treat each movie as an observation. The results (reported formally in Online Appendix C) are very similar to Table 8: the pattern of means is essentially monotonic, and those differences that are statistically significant with uncorrected standard errors remain so with jackknife standard errors.

Overall, our results in Table 8 suggest that the discounts for a given reel-week are an omitted variable in Table 7. Although not a direct test, these results are consistent with the model's prediction that the exhibitor continues movies she would have otherwise dropped or moved to a shared screen because she anticipates receiving a future discount.

4.4. Prediction 3: Effects of Heterogeneous Relationships

This subsection tests whether adaptation decisions favor movies for which the owner of a movie has a strong relationship with the exhibitor. The distributors in our main sample (i.e., those with observations in Categories

Table 8. Prediction 2: Are Movies That Are "Unexpectedly Continued" Renegotiated? (Stage 2)

	(1) Percentage renegotiated	(2) Average discount (%)	(3) Average discount (discount > 0) (%)
Panel A. Predicted continuation probability from Table 7, column (2) (n = 6,909)			
Lowest quintile (least likely to continue)	66.6	7.6	11.5
Second quintile	62.7	6.7	10.6
Third quintile	54.0	5.2	9.6
Fourth quintile	47.8	4.4	9.2
Highest quintile (most likely to continue)	39.0	3.3	8.4
Panel B. Predicted probabilities of continuing on unshared screen (conditional on continuation) from Table 7, column (4) (n = 2,819)			
Lowest quintile (least likely to continue unshared)	48.0	4.2	8.7
Second quintile	46.6	4.0	8.7
Third quintile	39.0	3.4	8.8
Fourth quintile	39.4	3.1	8.0
Highest quintile (most likely to continue unshared)	34.6	2.7	7.9

Notes. Observations correspond to theater-week-reels. A "renegotiation" reflects reels that are under contract where the final ex post price paid to the exhibitor (as a share of box office revenues) exceeds the ex ante contracted share. A "discount" is the difference between the ex ante and ex post share paid to the distributor. Predicted continuation probabilities in panel A are from the linear probability regressions in column (2) of Table 7 and reflect the probability that the exhibitor will show the reel for an additional week. Predicted probabilities of continuing on an unshared screen in panel B are from the linear probability regressions in column (4) of Table 7 and reflect the probability that the exhibitor will show only that reel on a given screen in week $t+1$, conditional on (a) showing the reel during both week t and week $t+1$ and (b) showing only that reel on a given screen in week t. The table entries in each column in panel A are all significantly different from each other at the 1% level or better with only two exceptions: the first and second quintiles in column (1) are significantly different from each other at the 5% level, and the third and fourth quintiles in column (3) are significantly different from each other at the 10% level. The table entries in each column in panel B are not all significantly different from each other. In both columns (1) and (2), the first and second quintiles are significantly different from the third, fourth, and fifth quintiles at the 5% level or better. In addition, quintile 4 is significantly different from quintile 5 at the 10% level in column (1), and quintile 3 is significantly different from quintile 5 at the 2% level in column (2); no other pairs are significantly different. In column (3), the first, second, and third quintiles are significantly different from the fourth and fifth quintiles at the 10% level of better; no other pairs are significantly different.

1 and 2 of Table 3) all make payments that are not required by any formal contract, suggesting that all rely on relational contracts to some extent. However, some distributors pay discounts much more frequently than others, and some distributors pay larger discounts than others, suggesting that these relationships are heterogeneous. Our estimation in this subsection exploits this heterogeneity.

Whereas our model and discussion have focused on the distributor–exhibitor relationship, we could have alternatively treated the *studio* as the active participant in this relationship, with the distributor a passive intermediary. In this subsection, we examine both distributor–exhibitor and studio–exhibitor relationships, remaining agnostic about the extent to which each of these relationships is critical.

Our third prediction is that a distributor (or studio) who has a more valuable relationship is more willing to offer larger discounts, and consequently, the exhibitor is more likely to continue that distributor's (or studio's) movies. This effect should be particularly apparent if $x > \beta v$ so that the movie would not be continued based on the formal contract alone. We test this prediction using proxies for both distributor–exhibitor and studio–exhibitor relationships.

To test the prediction that the exhibitor is more likely to continue a movie from a distributor with whom she has a strong relationship, we construct a proxy for the strength of a given distributor's relationship with the exhibitor. In the optimal relational contract from Section 3.1, the maximum discount is $b(\bar{x}) = 1/r(S^* - S^{OS})$, where the right-hand side of this expression is a measure of the value of the relationship. If we assume that (i) the maximum *observed* discount approximates $b(\bar{x})$ and (ii) $1/r(S^* - S^{OS})$ is roughly constant over time, then the maximum observed discount from each distributor should be positively related to the value of that distributor's relationship with the exhibitor.

Table 9 modifies columns (1) and (2) of Table 7 to include a proxy for each distributor's continuation surplus from his relationship with the exhibitor, as well as the interaction between these proxies and the *Reel at Risk* variable. We proxy for continuation surplus using observed discounts in the first half of our sample (January 2001–September 2001) and then estimate the effect of this proxy on continuation decisions in the second half (October 2001–June 2002). To proxy for continuation surplus, we use the maximum aggregate discount (in euros) for any of that distributor's movies, summed across all weeks and over all theaters.[33] Standard errors are, again, clustered by theater-week and reel.

The coefficient on the continuation-surplus proxy in column (1) of Table 9 (i.e., the logistic regression *without* movie-week fixed effects) is positive but insignificant with our two-way clustering.[34] The coefficient on the interaction between the continuation-surplus proxy and *Reel at Risk* is positive and statistically significant in column (1), suggesting that this heterogeneity is especially relevant for movies that face attractive outside options. We interpret this result as providing evidence that the exhibitor is more likely to continue movies from distributors who are willing to pay large discounts.

Because each movie has a single distributor, the direct effect of our proxy is absorbed in the movie-week fixed effect in column (2) of Table 9. However, the coefficient on the interaction terms in column (2) is positive and marginally significant at the 10% level, providing consistent evidence that distributors who appear to have strong relationships with the exhibitor are more likely to have their movies continued when doing so comes with a high opportunity cost.[35]

As noted above, exhibitors may have relationships with studios rather than distributors. The empirical challenge in examining the studio–exhibitor relationship is that movies are typically produced by groups of studios rather than a single studio. Our 435 movies were affiliated with 426 different studio groups. Although a given studio group almost never appears more than once in our data, many individual studios appear repeatedly. For example, 23 studios in our sample are involved in 10 or more of the 435 movies in our sample. To proxy for continuation surplus for movies with multiple studios, we compute the maximum discount observed for each studio during the first half of our sample and then compute the average of this maximum discount across all studios associated with a given movie.[36]

Columns (3) and (4) of Table 9 replicate columns (1) and (2), with our proxies for studio (rather than distributor) continuation surpluses from its relationship with the exhibitor and the interaction between these proxies and the *Reel at Risk* variable. Our results for studios are consistent with (but somewhat weaker than) our results for distributors. In particular, the coefficients on the continuation-surplus proxy are positive but insignificant in the logistic regression in columns (3) of Table 9. However, the coefficients on the interaction between the continuation-surplus proxy and *Reel at Risk* are positive and highly significant in columns (3) and (4), suggesting that the exhibitor is more likely to continue movies from groups of studios who are willing to pay large discounts. Collectively, the results from Table 9 suggest that distributors (or studios) with strong relationships are rewarded with longer-running movies, because they can better reward the exhibitor for making favorable adaptation decisions.

Table 9. Prediction 3: Are Movies Owned by Distributors (or Produced By Studios) Who Have Paid Large Discounts in the Past Associated with Higher Continuation Probabilities?

	Distributor–exhibitor relationship		Studio(s)–exhibitor relationship	
	(1) Logistic	(2) Linear	(3) Logistic	(4) Linear
ln(1 + *New Releases in week t* + 1)	−0.9759*** (−4.99)	−0.0805*** (−4.17)	−0.9861*** (−4.72)	−0.0847*** (−4.21)
ln(*Revenues in week t*)	2.396*** (14.10)	0.2064*** (11.78)	2.310*** (12.72)	0.1955*** (10.79)
Reel-at-Risk: Reel is among the *n* reels with lowest revenues (where *n* is the number of new releases in *t* + 1)	−1.380*** (−5.02)	−0.2488*** (−5.32)	−1.341*** (−4.34)	−0.2648*** (−5.16)
Maximum Aggregate Discount (€000's): Observed for any movie run from distributor, summed across theaters	0.0095 (1.17)			
Reel-at-Risk × *Maximum Aggregate Discount* (for any movie run across theaters)	0.0266*** (2.57)	0.00323* (1.90)		
Average Maximum Aggregate Discount (€000's): Observed for any movie run across all studios of focal movie, summed across theaters			0.0036 (0.28)	
Reel-at-Risk × *Average Maximum Aggregate Discount* (across studios for any movie run summed across theaters)			0.0371** (2.32)	0.00536** (2.19)
Theater fixed effects?	Yes	Yes	Yes	Yes
Reel-week fixed effects?	No	Yes	No	Yes
Sample size	5,358	5,358	5,027	5,027
R^2 (or pseudo-R^2)	0.4117	0.6712	0.3955	0.6672

Notes. The dependent variable is a (0,1) dummy indicating that a reel shown in week *t* was continued to week *t* + 1. The *t*-statistics (or asymptotic *t*-statistics) are shown in parentheses. Standard errors are clustered by theater-week and reel. The sample consists of all reels with formal contracts throughout their runs or moving from formal contracts to no contracts during their runs.

*, **, and ***Significance at the 0.10, 0.05, and 0.01 levels, respectively.

Whether the exhibitor's primary relationship is with the distributor or the studio, our analyses thus far have assumed that the exhibitor's outside option is the *total* box office revenue generated by the best dropped or shared movie. Table 9, however, suggests that some distributors might not be able to promise such large relational payments credibly. One might expect the distributors of a focal movie to pay larger relational discounts when the distributor who owns the best shared or best dropped movie has a strong relationship with the exhibitor.[37] Even in this case, however, the total box office revenue of a dropped or shared movie remains a reasonable proxy for x.

To complement our focus above on the bilateral efficiency of relational contracts, note that the heterogeneity in relationships documented in Table 9 has implications for the *social* value of relational contracts in this setting. If all distributors have strong relationships with the exhibitor, then the distributor with the most profitable movie can always outbid distributors with less profitable movies. In that case, the exhibitor's equilibrium adaptation decisions would maximize the joint welfare of *all* the distributors and the exhibitor. If distributors have heterogeneous relational contracts, however, then a distributor with a profitable movie but a weaker relationship might not be able to outbid a distributor with a less profitable movie but a stronger relationship, leading to an inefficient allocation of movies to screens.[38]

We can perform back-of-the-envelope calculations of the loss from this inefficiency by considering movie-weeks in which the focal movie continues with a renegotiation, even though the best alternative movie generates higher total box office revenues in that week. Across all such movie-weeks, the total difference between the best alternative and focal movies' box office revenues equals just over four million euros, or about 7% of the total revenue generated in these movie-weeks. Even this relatively modest loss likely overstates the true inefficiency, because it does not incorporate the fact that box office revenues decline during a movie's run.

5. Conclusion

This paper explores how firms use relational (and formal) contracts to adapt to fluctuations in their environment. Our model suggests that relational contracts can supplement incomplete formal contracts to induce state-contingent decision making that improves the parties' total expected payoffs. Using detailed data from the movie industry, our empirical analysis shows how the exhibitor's adaptation decisions respond both to opportunity costs from forgoing other reels and to anticipated payments from movie distributors. Collectively, our results suggest that the parties use relational renegotiation to facilitate adaptation.

Adaptation is a widespread economic phenomenon that is relevant in industries as diverse as airlines, automotive manufacturing, defense procurement, agriculture, and information services. Relational contracts are potentially important whenever parties would find it difficult or costly to make formal contracts contingent on time-varying, payoff-relevant variables. Therefore, empirical analyses of decision making that ignore relational adaptation may miss an important driver of observed behavior, because firms' decisions can be governed as much by relational as by formal contracts. Fortunately, as we illustrate for the movie industry, relational adaptation can be studied empirically, because the economist may observe (or approximate) formal contracts, relational payments, adaptation decisions, and the state of the world. Given that adaptation is fundamental to many economic contexts, and given that relational contracts can substantially alter adaptation decisions, and hence economic welfare, we suggest that relational adaptation is an important phenomenon that warrants further theoretical modeling and empirical testing.

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Endnotes

[1] Much of Williamson's (1975) work takes this position, for example, arguing that "incomplete contracting with informal enforcement" can mitigate "maladaptation" (p. 107)—that is, facilitate efficient adaptation.

[2] Relational contracts are particularly important if enforcement institutions are weak. For example, McMillan and Woodruff (1999) examine informal interfirm relationships in Vietnam, Macchiavello and Morjaria (2015) analyze adaptation to a supply shock in the export market for flowers in Kenya, Macchiavello and Morjaria (2019) study relational contracts in the coffee supply chain in Rwanda, and Antras and Foley (2015) show how legal and other institutions shape trade contracts in the frozen poultry market. However, relationships can

matter even if legal institutions are strong. See Bernstein (1992, 2015) on the diamond industry and U.S. original equipment manufacturer firms, Corts and Singh (2004) on offshore drilling, Gillan et al (2009) and DeVaro et al (2017) on chief executive officer compensation, Gil and Marion (2012) on highway procurement, and Gil et al (2017) on airlines.

[3] Much of Klein's work explores other ways that formal contracts can support relational contracts; for example, see Klein (2000).

[4] See Hanssen (2002), Filson et al. (2005), and Gil and Lafontaine (2012) for evidence that continuation decisions are not predetermined by contract but rather are made by the exhibitor on a week-to-week basis after observing the prior weekend's box office results.

[5] As noted above, a theater often shows different reels of the same movie on different screens, which allows separate agreements for each reel. In our data, we define the reel with the highest box office revenues to be the "first reel," the reel with the second-highest revenues the "second reel," and so on. Our estimates with reel-week fixed effects thus compare the *n*th reel of a given movie in one theater to the *n*th reel of the same movie in other theaters during the same week. Our major findings are unchanged if we restrict attention to focal movies that are first reels (with additional reels still contributing data about opportunity costs).

[6] Several papers study formal distributor–exhibitor revenue-sharing contracts without considering ex post adjustments or renegotiations. Hanssen (2002), for example, studies the transition from flat-fee to revenue-sharing contracts in movies as a result of the introduction of sound, and Raut et al. (1998) argue that revenue-sharing contracts may deliver superior performance at cheaper administrative cost than alternative contracts. Dana and Spier (2001), Cachon and Lariviere (2005), and Mortimer (2008) study revenue-sharing contracts in the video retail industry and show that revenue-sharing arrangements are valuable when demand is uncertain.

[7] Along similar lines, Caves (2002, p. 167) interprets renegotiations as reflecting "the balancing of equities over time that commonly occurs between partners in repeated transactions."

[8] For example, Squire (1992, p. 343) quotes Loews Theater chairman Alan Friedberg: "The real dance goes on once box office figures are a matter of record. . . . [R]easons generally related to expenses are offered on both sides—sometimes leading to acrimonious debate—as to why one party should ultimately receive a greater share than the original deal would allow. In the end, agreement is reached and payment is made." See also Filson et al. (2005) and Cones (1997) for the United States and Gil (2013) for Spain.

[9] As discussed in Section 4.1, we proxy for "prime-time slot" by excluding theater-reel-weeks with fewer than 100 weekly attendees.

[10] The exhibitor also has other continuation decisions that we do not analyze, such as showing a movie in a screen with more seats or fewer seats, showing a three-dimensional versus two-dimensional version of the movie, showing the movie on alternate days, moving a movie in a prime-time slot to a matinee or after midnight, and so on.

[11] The distributor might also prefer that the reel be transferred to a theater with higher expected revenues from additional screenings. However, with the exception of some "limited release" movies (i.e., movies shown in select theaters in advance of a national release), there is typically an excess supply of reels after the initial release week (as theaters begin discontinuing the reel), so the distributor's opportunity cost of an additional screening in any particular theater is essentially zero.

[12] Filson et al. (2005) analyze distributor–exhibitor contracts from a U.S. movie exhibitor owning 13 theaters in the St. Louis area. They show that formal contracts typically involve simple sharing rates but for a small set of anticipated blockbusters sometimes are piecewise linear, where the distributor receives a higher share (e.g., 90%) after exceeding a weekly box office threshold. Regardless of the formal contract, Filson et al. document frequent renegotiation of these contracts after the movie's run has finished, suggesting (consistent with our Spanish data) that relational renegotiation may improve on the formal contract.

[13] Theater names are concealed to preserve confidentiality.

[14] Several theaters showed *A Beautiful Mind* on multiple screens (using multiple reels) during its first few weeks. In theaters with multiple reels, the discount in the table is associated with the "first reel" as defined above.

[15] Restricting attention to first reels, approximately 75% of 1,085 movie weeks have the same formal contracted share across theaters in a given week.

[16] Robustness tests (unreported) show that the results below are not sensitive to the specific threshold used as a proxy for prime-time movies, provided that the threshold exceeds 25.

[17] For example, if the average contracted distributor share for reels subsequently renegotiated was 60%, the average renegotiated distributor share was 49.5%.

[18] Category 2 consists primarily of successful movies continued beyond their initial contracting period: compared with Category 1, reels in Category 2 had longer average run lengths (8.9 weeks versus 4.0 weeks), higher average weekly box office revenues (€5,658 versus €4,090), and higher average weekly attendance (1,329 versus 974).

[19] There were fewer reels than screens in 39 (2%) of our theater weeks, presumably reflecting refurbishing, maintenance, and reels excluded based on our 100-attendee threshold.

[20] Although a distributor could literally "sell the reel" to the exhibitor, this selling would differ importantly from "selling the firm to the agent" in an agency model, because the latter means giving the agent title to all the consequences from the agent's action, whereas literally selling a given reel to the exhibitor would not preclude the distributor from selling identical reels to other exhibitors (or broadcasters or directly to consumers) and would not convey the rights to revenues from sequels, worldwide merchandizing, and so on. We include two-sided moral hazard in our model to preclude this broader sense of selling the firm to the agent.

[21] Without the formal contract (β) and the distributor's moral hazard (a), this static model would be an elemental "adaptation" model. See Gibbons (2005) on how Simon (1951) and Williamson (1971) launched this approach. See Baker et al. (2011) for a repeated-game model of relational adaptation where the parties can choose the allocation of formal decision rights (but not a formal contract) to help enforce their relational contract.

[22] The assumption of Nash threats is without loss if $D^{OS} = K$. Otherwise, the optimal relational contract without this restriction might be more efficient than the equilibrium described here. However, although allowing harsher punishments might improve equilibrium surplus, such punishments would not affect the basic features of on-path play. In particular, for any punishment payoffs, our three empirical predictions hold for appropriate discount rates.

[23] As in Levin (2003), there exists a stationary optimal relational contract in our setting: that is, decisions in a period affect transfers in that period but do not affect decisions in future periods. One could imagine a model without transferable utility in which future continuation decisions are inefficiently biased to reward or punish the exhibitor for past decisions, along the lines of Green and Porter (1984) or Li et al. (2017). From an empirical standpoint, we explored whether continuation decisions for one movie affect future continuation decisions for other movies, but we did not find evidence for such dynamics.

[24] As an extreme example, if the cost of formally contracting on d or x were larger than the difference in bilateral surplus between efficient adaptation and the one-shot contract, then the parties would not pay it.

[25] This discussion could accommodate distributors with multiple movies, allowing for unexpectedly high revenues from one movie to cross-subsidize unexpectedly low revenues for another movie from the same distributor. In practice, however, cross-subsidization is

limited by the (unmodeled) fact that different movies have different coalitions of studios, making such cross-subsidization at least difficult and perhaps a cause for litigation.

[26] A movie's release in a given *week* and a given *theater* might depend on the other movies in that week and at that theater. Most movies have nationwide release dates, so our movie-week fixed effects control for the endogenous timing of such movie releases. Regarding release-location choices, we use data from Gil (2009) in (unreported) regressions that check whether "blockbuster" movies (as measured by U.S. box office returns) are released in locations where they do not directly compete with other blockbusters. We find no evidence that they are, at least somewhat mitigating the concern that release location is endogenous.

[27] The results in Table 5 (and Table 6) become more significant when constraining the sample to only the first reel of a movie in the theater (with multiple reels still included in our proxies for opportunity costs).

[28] Specifically, the coefficients on "best dropped" remain significant when the focal and best dropped are the same movie, whereas the coefficients on "best shared" are insignificant. Note that the revenues from the "best dropped" or "best shared" movies are likely correlated with other movies that are dropped or shared in the same week.

[29] Table 6 includes observations with and without discounts, allowing us to estimate the reel-week fixed effects more precisely. The results become more significant when constraining the sample to observations with positive discounts.

[30] Specifically, the coefficients on "best shared" are insignificant in the counterparts to columns (2) and (3) in Table 6. The coefficients on "best dropped" are significant in the regression corresponding to column (1) of Table 6 but insignificant in the regression corresponding to column (3).

[31] Second-stage results based on the logistic estimates in columns (1) and (3) are qualitatively similar.

[32] These predicted continuation probabilities are perfectly correlated with the residuals from Table 7 because the dependent variable from Table 7 equals 1 for all observations included in Table 8.

[33] This approach assumes that the distributor offers a single lump-sum payment for all theaters and all weeks. The exhibitor then assigns that payment to different weeks and different theaters in our data.

[34] The coefficient is highly significant when clustering standard errors only by theater-week (and not by year), suggesting that exhibitors are more likely to continue movies from distributors who have historically paid high discounts.

[35] The t-statistic on the interaction increases from $t = 1.90$ to $t = 3.14$ when clustering standard errors only by theater-week.

[36] As an illustrative example, suppose that the focal movie was coproduced by Studio A and Studio B, and that the maximum observed total discount for any movie across all theaters and all weeks was €6,000 for Studio A and €9,000 for Studio B. Our proxy for the continuation surplus for this movie would then be €7,500 (i.e., the average of the maximum aggregate discounts for the entire movie run across theaters).

[37] In an unreported test of this prediction, we replicated Table 6 after including interactions of the ratio of the revenues of the best dropped (or best shared) reel and an indicator indicating whether the exhibitor has a strong relationship with the distributor or any of the studios associated with the best alternative movie. As in Table 9, we estimated the regression on the second half of the sample, using the data from the first half to estimate the strength of the relationship. After controlling for theater and movie-week fixed effects, we find no significant coefficient on the interactions for the distributors or studios associated with the best dropped or best shared reel.

[38] In principle, it might even be possible that eliminating relational contracts could improve welfare, because then distributors would have equal access to formal contracts.

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