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(Article begins on next page)

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Abstract

Our paper tests a key prediction of property rights theory: that agents respond to marginal incentives embedded in property rights, when making non-contractible, revenue-enhancing investments. (Grossman and Hart, 1986; Hart and Moore, 1990). Using rich project-level data from the US film industry, we exploit variation in property right allocations, investment choices, and film revenues to test the distinctive aspects of property rights theory. Empirical tests of these key theoretical predictions have been relatively sparse due to the lack of appropriate data. The US film industry displays two distinct allocations of property rights, which differentially affect marginal returns on a particular class of investments. Studio-financed films are produced and distributed by studios which take in the lion's share of revenue. In contrast, independent films are distributed by studios under revenue sharing agreements, which give studios 30-40% of the revenue stream. Under either regime, the allocation of scarce marketing resources is determined by and paid for by the studio. After accounting for the endogenous nature of property-right allocations, we find that studio-financed films receive superior marketing investments compared to independent films and that these investments fully mediate the positive effect of vertical integration on film revenues. As a result, this study contributes to the empirical literature on property rights by showing that both predicted linkages (from marginal returns to investment and from investment to revenue) exist in a single empirical setting.

2

In this paper we exploit institutional features of the U.S. film industry to test a key prediction of property rights theory: that agents respond to marginal incentives embedded in property rights, when making non-contractible, revenue-enhancing investments. (Grossman and Hart, 1986; Hart and Moore, 1990) The importance of contractibility and the impact of marginal incentives on *ex ante* investments are two ways in which property rights theory differs from transaction cost economics (TCE) in predicting the boundaries of firms (Whinston, 2003; Lafontaine and Slade, 2007). But while TCE theories of firm boundaries have been extensively tested (see Lafontaine and Slade, 2007 for a review), tests of the distinctive aspects of property rights theory are relatively sparse.

The US film industry displays two distinct allocations of property rights, which differentially affect marginal returns on a particular class of investments. Studio-financed films are acquired by major distributors before filming takes place. In most cases, the studio then pays production and marketing costs and receives substantially all of net revenue from the film, after payments to theatre owners. In contrast, so-called independent films contract with studios for distribution after filming takes place. The contracts are most commonly revenue-sharing agreements wherein the studio gets approximately 30% of net revenue as a distribution fee and the independent producer gets the balance (Caves, 2000; Corts, 2001). After filming takes place, the costs of producing the movie are sunk, but marketing investments remain to be determined. And regardless of whether the film is studio-financed or independent, according to industry practice, the studio exercises control over marketing decisions and pays 100% of residual marketing expenses (net of direct print and advertising charges) (Corts, 2001; Sorenson and Waguespack, 2006).

The presence of revenue-sharing agreements for independent films plus the fact that studios both control and pay 100% of residual marketing costs means that the two film types offer studios different marginal returns on their marketing investments. If marketing is a non-contractible investment, property rights theory predicts that (1) studios will underinvest in the

marketing of independent films relative to studio-financed films; and (2) the underinvestment will have a negative impact on the revenues of independent films.

Using a sample of 1092 studio-financed films and 428 independent films released between 1994 and 2008, and controlling for endogenous selection, we test these predictions. We control for the endogeneity of the financing decision (the choice of film type) using a two-stage treatment effects model (Heckman, 1979). We then explicitly test for mediation—that film type affects revenue *through* marketing investments—using a three-stage model (Shaver, 2005). Subject to caveats discussed below, our tests provide evidence that marginal incentives do affect marketing investments in the predicted direction, and also show that marketing investments positively and significantly affect subsequent box-office revenues. We further hypothesize that underinvestment in marketing reduces the value of large-budget films more than small-budget films. Consistent with this hypothesis, we show that large-budget films are more likely to be studio financed than small-budget films.

This paper thus provides empirical support for two key tenets of property rights theory: (1) different marginal incentives conveyed by property rights affect downstream non-contractible investments; and (2) such investments in turn affect subsequent economic performance. In formal models based on these assumptions, Grossman and Hart (1986) and Hart and Moore (1990) have argued that allocations of property rights are not value-neutral: some configurations of ownership rights can create more value than others. Our analysis indicates that, *ceteris paribus*, studio-financed films are more valuable than independent films. (This raises the question of why independent films exist at all, which we address in the conclusion.)

In addition to testing key predictions of property rights theory, this paper also contributes to the broader literature on vertical integration. The literature can be divided into three parts: (1) studies of the decision to vertically integrate; (2) studies of the consequences of vertical integration for investment behavior; and (3) studies of the impact of vertical integration on performance.

A very large number of studies have looked at the decision to vertically integrate forward or backward, and we will not be able to do justice to that literature here. LaFontaine and Slade (2007) provide a comprehensive overview. Notably, the literature focused on forward integration shows that concerns about agency and marginal incentives affect the decision to vertically integrate. Specifically, empirical studies of the ownership of retail outlets show that, as corporate effort becomes more important, vertical integration is more likely, and conversely as monitoring of retail agents becomes more costly, integration is less likely (LaFontaine and Slade, 2007, p. 647). Pointing to the formal similarities between agency and property rights models, LaFontaine and Slade (2007) argue that these results can be interpreted as supporting the distinctive predictions of property rights theory.

The impact of vertical integration on investment behavior has been investigated by Mullainathan and Scharfstein (2001), Acemoglu et al. (2010), Ciliberto (2006), and Gil (2009). Using data on capacity investments made by chemical firms in the plastics industry, Mullainathan and Scharfstein (2001) show that vertically integrated firms invest more heavily in plant capacity than do non-integrated firms. Acemoglu et al. (2010) examine firms from the United Kingdom and find that firms that produce a higher proportion of their inputs in-house also exhibit higher R&D investments. Ciliberto (2006) investigates vertical integration between physicians and hospitals and finds that over time integrated hospitals add more healthcare services than non-integrated hospitals. Forman and Gron (2011) show that vertical integration in distribution increases the speed with which insurers adopt complementary consumer Internet applications. Finally, Gil (2009) explores vertical integration between distributors and theater owners in the Spanish movie industry, and finds that integrated theaters run their own movies for longer periods than other movies. Broadly speaking, these papers show that vertical integration differentially affects firms' investment decisions, but do not consider the determinants of vertical integration choices nor the subsequent impact of the investments on performance.

Another stream of literature compares the performance of vertically integrated and non-integrated firms on various dimensions but does not link performance to investment. Comparing internal procurement, alliances, and market transactions in the automobile industry, Gulati et al. (2005) find that intermediate levels of vertical integration, i.e., alliances, outperform both internal procurement and market transactions when the task structure is interdependent and the transaction environment unstable. Forbes and Lederman (2010) find that vertical integration between major and regional airlines reduces departure delays. Using satellite tracking data, Natividad (2012) finds that vertical integration boosts the productivity of fishing vessels, seemingly because the owned vessels follow headquarter instructions more faithfully.

A small but growing number of papers specifically examine the consequences of vertical integration for new product performance (Macher and Richman, 2008). Leiblein et al. (2002) examine the impact of vertical integration on the technological performance of new products. Macher (2006) and Macher and Boerner (2012) look at manufacturing efficiency and development speed. Rothaermel et al. (2006) consider the reviews new products receive from experts. Adner and Kapoor (2010) and Kapoor and Adner (2011) look at firm-level market share and time-to-market for new product generations. These studies shed light on the relationship between vertical integration and product outcomes, but, because of data limitations, they cannot show how differences in product outcomes affect firms' revenue or profitability.

Recently, Gil and Warzynski (2010) have shown that video games produced in a vertically integrated manner obtain higher revenues, possibly as a result of better release timing and post-release marketing strategies. However, their analysis does not take account of the potential endogeneity of the vertical integration decision. The present paper extends their work by controlling for endogeneity and by testing for a mediation effect between marketing investment and revenue. To our knowledge, this paper is first to provide evidence that vertical integration affects the revenue of specific products *through* its impact on marketing investments in those products.

The rest of the paper is organized as follows. We next present an overview of the U.S. motion picture industry, highlighting its structure, financing arrangements, and the challenges faced by 'independent' productions. We then derive specific hypotheses with the help of a theoretical model. We go on to describe our data, present our empirical tests and results, and offer robustness checks and alternative explanations. The final section concludes.

Institutional Background

Basic Organization

Film-making can be divided into four stages: concept development, film production, distribution, and screening. The concept development stage begins when a producer procures or 'options' a film script from a literary agent. The producer is typically an individual or group of individuals (who may or may not have their own production company). The producer then makes choices regarding the film's budget, director, and cast. Costs incurred in the concept development stage are relatively low and borne by the producer. Once the producer has assembled a project with a principal cast and projected budget, she must then seek financing for the film – either from a distributor or other sources. Films that are not financed by a distributor, but by independent sources are called 'independent films' (Martin, 2009).

During the production stage, a crew is formed and the film is shot (typically over the course of a few months) and then edited. When filming is complete, most of the production costs are sunk, and the movie is said to be "in the can."

Once a movie has been produced, it must be distributed to theaters. Distribution entails the physical distribution of prints to theaters, marketing the movie in each territory, and monitoring the collection of revenues from theater owners (Eliashberg et al., 2006). A number of key decisions are made by distributors concerning the marketing strategy for the film. These include the amount of marketing expenditures that they should invest to promote the film, and

which media to use in the advertising campaign (ibid.). Furthermore, distributors negotiate with theater operators over the number of screens that movies will be allocated in their opening week.

Six major studios—Paramount Pictures, Universal Studios, Warner Bros. Pictures, Sony Pictures, Twentieth Century Fox, and Disney—control essentially all film distribution in North America, thus in the industry the terms "studio" and "distributor" are used interchangeably. Using data on screens and distributors from *Variety Magazine*, we determined that movies distributed by these six companies occupy (on average) over 85% of all theater screens available in a given week. A significant entry barrier into the distribution market lies in the fixed cost of a maintaining a sales network with offices across North America to negotiate and arrange contracts with theater operators for each film. These sales offices of the network hold the "assets of local knowledge and the advantages of repeated dealings with exhibitors", and the system as a whole is capable of coordinating the large-scale simultaneous promotion for different films (Caves, 2000).[1]

The capabilities of distributors to negotiate and secure theatrical screens and to market films to the public represent a resource vital to the commercial performance of any film. As a result, theatrical distribution represents a complementary asset (Teece, 1986) – any movie produced upstream must secure access to these distribution resources in order to succeed commercially.[2]

Film Types, Financing and Revenue Shares

As indicated a film may be studio-financed or independent. For a studio-financed film, in most cases, the studio pays all production and marketing costs and has rights to all rental

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[1] The distribution marketplace has remained very concentrated amongst a few firms for several decades despite entry. New distributors who entered the market failed and exited due to their lack of strong relationships with theater operators and an inconsistent pipeline of product to offer these operators (Caves, 2000).

[2] If a movie cannot secure theatrical distribution, it may still be released directly on DVD. However, the commercial upside remains limited since theatrical release and the marketing that accompanies it represent a significant driver of DVD sales (Ravid, 1999; Sorenson and Waguespack, 2006).

revenue, after payments to theatre owners, which are typically 30% of gross box-office receipts.[3] Throughout the process, the studio maintains residual rights of control over the project, including the right to fire and replace individuals. In contrast, for an independent film, a production company pays the production cost and maintains residual rights of control. For such films, the distributor typically keeps 30% of domestic rental revenue and 40% of foreign rental revenue as a distribution fee (Sorenson and Waguespack, 2006; De Vany, 2006). The rest of the revenue, net of direct print and advertising costs, is paid to the production company.

Studio-financed films are sometimes "co-financed" by an independent production company or another studio. In such cases, the two financing entities will split the film's revenue after paying a distribution fee. Goettler and Leslie (2005) found that between 1987 and 2000 approximately one-third of studio-financed films were co-financed. Co-financed films have marginal returns that are lower than solo-financed films, but higher than independent films. For example, Disney's agreement with Pixar gave Disney approximately 55% of the net revenue of those co-financed films. Our theoretical model allows for variation in the marginal returns to studio-financed films.

Several prior studies have explored the production-distribution interface in the movie industry. Corts (2001) examines the release-date choices of distributors and finds that when two films share a production company and a distributor, the films are released further apart. Doing so softens direct competition between the films. Fee (2002) explores the choice of distributors to finance films and finds that it is less likely when the project has high 'artistic stake' i.e. when the producer of the film, also served as its director and writer. Sorenson and Waguespack (2006) focus on past ties between the distributor and the principal participants of the movie project (the director, producer, cast, and writer) and find that such ties enhance the film's budget and marketing expenses, but have a negative effect on overall revenues. To date however, no study has examined how studio financing decisions affect downstream investment and revenue.

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[3] In some cases, revenue share may be allocated to the director and/or actors. Such "points" if they are given at all, are generally small, less than 5% of box-office receipts.

Economics of Independent Films

In the early 1990s, digital technology lowered the barriers to entry for many independent filmmakers, and new sources of financing emerged for independent producers (Levy, 1999). At the same time, the commercial potential and artistic quality of independent films came to be recognized. In 1992, independent films Howard's End, The Crying Game, and The Player, were not only box-office smashes, but also received more Oscar nominations than any of the movies produced by the major distributors (Levy, 1999). By 1994, the studios realized that the distribution of independently produced films could represent a lucrative source of profits. As a result, all six studios launched new divisions to acquire independent films and to finance similar projects in-house.

Notwithstanding the studios' increased willingness to distribute independent films, the harsh reality facing independent producers is that most will fail to secure a distribution contract necessary to being their film to theatre screens. Of the 9,000 independent films completed each year, only 5 percent are able to obtain access to theatrical distribution (IndieVest, 2006). In contrast, over 93 percent of studio-financed films receive theatrical distribution.[4]

Film festivals are essentially organized markets for the 'acquisition' of independent films by distributors. However, competition for festival slots is intense. For example, in 2009 the prestigious Sundance Film Festival received 3,661 film submissions for 120 slots (Martin, 2009). Also only a subset of films screened at festivals go on to secure distribution contracts. In the case of Sundance, only around 25 percent of the films screened leave the festival with distribution agreements for theatrical release (Barnes, 2010). As a result, independently produced films, even those of 'worthy' quality, face considerable uncertainty regarding their ability to gain access to downstream distribution. Geoff Gilmore, the director of the Sundance Film Festival, recently

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[4] The remaining 7% are released directly on home video (DVD) either because their quality was extremely poor, or because of a deliberate attempt to produce a film for the home entertainment market.

declared that "the biggest issue facing independent film is the theatrical distribution bottleneck" (Gilmore, 2009).

Empirical Approach

Basic Model

In this section we specify a basic model of property rights, from which we derive our hypotheses. The model closely follows Antràs (2003, 2011), and posits a Cobb-Douglas form of revenue function. This functional form makes investments in production and marketing complementary (in the sense of Milgrom and Roberts (1990)), so that films that are more costly to produce on average warrant higher levels of marketing investment. This assumption is consistent with our data.

We assume that the expected rental revenue of a film (that is, revenue net of payments to theatres) is a function of the film's production cost, P; marketing cost, M; and a random shock, $\tilde{n}$, which occurs post-production, but pre-marketing:

$$R_0 = aP^x \tilde{n} M^y \quad ;$$

where $a > 0, \; 0 < x, y < 1, \text{ and } x + y < 1$. In addition, $E(n) = 1 \text{ and } S_n^2 > 0$. The subscript 0 indicates that this is a pre-production revenue estimate. Here a is a factor that summarizes the impact of various *ex ante* observables (genre, script, etc.) on revenue. P represents production cost, which is observable (perhaps with error) and x represents the elasticity of revenue with respect to production cost.[5] We interpret n as an adjustment in revenue expectations that results from seeing the actual film (as opposed to reading a script and proposal).[6] In the movie industry, the quality and commercial potential of a film is extremely difficult to predict before it is

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[5] We assume that production costs are largely fixed for a given film by the requirements of the script, but differ substantially across films. In other words, the script establishes what production costs are necessary, and, except within a narrow band, one cannot increase *ex ante* revenue estimates by simply increasing the production budget. In contrast, for a given film, marketing expenses can vary over a wide range, depending on how intensively the studio markets the film.

[6] There will be additional shocks once the film is shown to critics and screened in theatres, but we suppress those in the interest of notational simplicity.

produced (De Vany, 2006). As Oscar-winning screenwriter William Goldman famously noted, "Nobody knows anything" (Caves, 2000). Thus we expect S_n^2 to be large and to have significant effects on *ex post* marketing investments.

Importantly for our empirical analysis, at the end of the second stage of film-making, when the movie has been produced and is about to be distributed, production costs are sunk and the realization of n is known. Hence the post-production revenue estimate, denoted R_1, is:

$$R_1 = (aP^x \hat{n})M^y \quad .$$

The terms within parentheses are known when the marketing investment is decided. They are observable to studio decision-makers, but not necessarily to outside observers. To simplify notation, we define $A \circ aP^x n$. Note that A is a random variable pre-production but a known quantity post-production.

As discussed, two types of films enter the distribution channel: studio-financed films where the distributor claims a higher percentage of revenue and independent films where the distributor takes a lower percentage and remits the rest of the revenue (net of certain direct expenses) to the producer. From industry practice, the distributor is responsible for marketing investments in either case. We make two additional assumptions: (1) marketing investments are non-contractible; and (2) y, the marginal impact of marketing investments on revenue is the same for both studio-financed and independent films.

In terms of property rights theory, studio-financing represents a form of vertical integration, in which the downstream agent controls both stages of a production process (in this case filming and distribution) (Hart, 1995; Antràs, 2003, 2011). The opposite form, where the upstream agent controls both stages, is not observed in the industry. Thus, in what follows, we will use the terms "studio financing" and "vertical integration" interchangeably.

Under property rights theory, if a given class of investments is non-contractible, then the party that controls those investments will maximize its own profit by setting the marginal benefit

equal to marginal cost. In our context, marginal benefits differ across film types. Thus, letting the subscripts *V* and *I* denote vertically integrated and independent films respectively, we have two maximization problems:

Vertically integrated films: $\max_{M_V} A b_V M_V^y - M_V$; and (1a)

Independent films: $\max_{M_I} A b_I M_I^y - M_I$. (1b)

Here b_V and b_I denote the studio's revenue share in vertically integrated and independent films respectively. Industry practice dictates that $b_V > b_I$.

Solving for optimal marketing investments, we have:

Vertically integrated films: $M_V^* = (b_V A y)^{1/(1-y)}$; and (2a)

Independent films: $M_I^* = (b_I A y)^{1/(1-y)}$. (2b)

Since $b_V > b_I$, the optimal marketing investment in an independent film less than the optimal investment in a comparable vertically integrated film. This leads to our first hypothesis:

H1: If marketing investments are non-contractible, studios will invest more in marketing their own studio-financed films than comparable independent films.

We can also substitute the optimal marketing investments into the *ex post* revenue functions (for simplicity, we suppress the time subscripts on revenue):

Vertically integrated films: $R_V = \hat{A}(M_V^*)^y$; and (3a)

Independent films: $R_I = \hat{A}(M_I^*)^y$. (3b)

Because of lower marketing investments, the rental revenue from an independent film will be less than revenue from a comparable independent film. Since rental revenues are by formula approximately 70% of gross box-office receipts, this leads to:

H2a: If marketing investments are non-contractible, the box-office receipts of studio-financed films will be higher than those of comparable independent films.

H2b: The revenue effect will be mediated by higher marketing investments.

Our theoretical model and the hypotheses derived from it are driven by differences in marginal returns to studios from the marketing of vertically integrated and independent films. For the predictions to be valid, some studio decision-makers must *perceive* this difference and act in a manner consistent with property rights theory, i.e., they must withhold marketing resources from independent films relative to comparable studio-financed films. At least one studio executive we interviewed showed full awareness of the different economic incentives associated with the two film types. Her studio had recently distributed an independent film (that we will call 'IndieFilm' for confidentiality purposes) which was not only a success at the box-office, but a critical success as well with one of the film's actors winning an Academy Award for her performance. However, in discussing the film, she remarked "[IndieFilm] was great, but we didn't own the movie, we just earned a fee." She went on to note that when you don't own a movie, but merely distribute it "you're only earning between 12-20% depending on the volume[7] … if it's our movie we earn all of it, but we have to recoup our investment." Finally, she highlighted the financial pressures that the studio was under to stabilize earnings in the face of persistent pressure and scrutiny from the investor community. This gave us reason to believe that our model was a reasonable (albeit incomplete) characterization of studios' investment behavior.

Finally, we ask which films are likely to be studio-financed vs. independently produced? To address this question analytically, we first define the expected contribution of a film, C, as its expected revenue minus marketing investments: $C = R - M$. Expected contribution can be assessed at *t=1*, when marketing decisions are made, or at *t=0*, when financing decisions are made.

Consider a particular film at *t=0* with a given production cost, P, which can be studio-financed or independently produced. Let d_V and d_I respectively denote the *ex-ante* probability that a studio-financed or independent film will obtain theatrical distribution. As discussed above,

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[7] The distribution fee quoted of 12-20% is lower than the typical distribution fee of approximately 30% reported elsewhere in this article and in other sources (Corts, 2001; Sorenson and Waguespack, 2006). Nevertheless, the fact remains that the marginal return from distributing independent films is significantly lower than that from the distribution of studio-financed films.

independent films have greater difficulty securing distribution than studio financed films, thus $d_V > d_I$. The difference in *ex ante* values between the film if studio financed and the same film independently produced is:

$$\overline{D} = d_V C_{0,V} - d_I C_{0,I} \quad ;$$

where $C_{0,j}$ denotes the expected contribution of each film type as of *t=0* and $\overline{D}$ denotes the difference between these values adjusted for the probabilities of distribution. (Production costs are the same in either case, hence drop out of this equation. For simplicity, we ignore discount rates, assuming they are also the same in both cases.)

Substituting for R and M^* in the contribution functions and rearranging terms, we have for each realization of $\hat{n}$:

$$D(\hat{n}) = (aP^x \hat{n})^{1/(1-y)} \cdot (d_V b_V^{1/(1-y)} - d_I b_I^{1/(1-y)}) \cdot (y^{y/(1-y)} - y^{1/(1-y)}) \quad . \tag{4}$$

Since $d_V > d_I$, $b_V > b_I$, and x and y all lie between zero and one, $D(\hat{n})$ *is positive and strictly increasing in production cost*. Thus for every realization of the random variable n, the value of the film will be higher if it is studio-financed, and more importantly, the difference in value increases with the film's *ex ante* production cost. And, since the relationship holds for every realization of n, it holds *a fortiori* for $\overline{D}$, the expected value of D taken with respect to n. Thus $\overline{D}$ is increasing in production cost.

Let us assume that for a given film, studio-financing occurs if $\overline{D} + \tilde{e} > 0$, where $\tilde{e}$ is the sum of a set of unobservable factors which also affect the financing decision. As long as the distribution of $\tilde{e}$ is constant across films, then, as production costs increase, it is less likely that $\hat{e} < -\overline{D}$, i.e., that other factors will offset the value of studio financing. In this case, the probability of studio-financing will go up with production cost. This leads to:

> *H3: Films with large* ex ante *production costs, that is, large budgets, are more likely to be studio-financed than films with small budgets.*

Hypotheses 1-3 hold under the assumption that marketing investments are non-contractible. If marketing investments were contractible, the independent producer and the distributor could agree on the appropriate level of investment and split the resulting (higher) revenue between themselves.

Interestingly, marketing investments do seem to be contractible *at the local level*. Distributors regularly negotiate screen allocations with theatre owners and secure screens by committing to spend a certain minimum amount on advertising and promoting the film. Theater owners are in a good position to monitor distributors' actions in their own markets. The owners and distributors are also in a relational contract with frequent interactions and high reneging costs (Baker et. al. 2002). If a theater owner felt the distributor had stinted on marketing investments for a given film, it would be relatively easy to withhold screens on the next round. As a result, the number of screens on which a movie is released in its opening week is intimately tied to the marketing budget for the film. Prior work has found that the number of opening screens for a movie is highly correlated with actual advertising expenditures (Sorenson and Waguespack, 2006; Elberse and Eliashberg, 2003).

The contracting problem between distributors and independent production companies is more difficult. To monitor the studio's behavior, a production company would have to gather data on advertising and promotion in all markets where the film was released. Also, independent production companies bring new films to market relatively infrequently, thus, the relational contracting threat of withholding the next film may not be a major concern for the studio. (In principle, the studio and the production company might negotiate on the number of opening screens, which *is* a reliable indicator of marketing investment. But by law studios are not supposed to control theatrical exhibition, and thus a contractual promise to deliver a certain

number of screens for a given film would almost certainly be unenforceable as well as raising antitrust concerns.[8])

Alternatively, the problem of non-contractible marketing investments might be addressed by changing the nature of the transaction between distributors and independent producers. If studios *purchased* independent films outright, instead of entering into revenue-sharing agreements, they would have incentives to make better marketing investments. Thus standard industry practice presents something of a puzzle from the perspective of optimal contracting. For now, as in Gil (2009), we will take standard industry practice as given. In the conclusion, we will offer a conjecture as to why this seemingly suboptimal form of contracting persists.

Empirical Challenges

As indicated in the introduction and expressed in the model, property rights theory posits two causal linkages: from marginal incentives to investment and from investment to revenue. Both linkages are important for our tests. To test the distinctive predictions of property rights theory, we need to show, first, that film types *cause* higher (or lower) levels of marketing investment in accordance with their marginal returns, and, second, that marketing investments *cause* revenues to move in the predicted direction.

The need to establish causality naturally creates challenges for our empirical tests. In this industry, the financing decision that determines marginal returns to each film type is an endogenous choice, which may be affected by many factors, including (we hypothesize) production cost. Many of these factors are unobservable and some might directly or indirectly affect marketing investment and/or revenue via other channels of causality. To address this issue, we adopt a multi-staged analysis using instrumental variables (discussed below).

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[8] The Supreme Court decision in U.S. v. Paramount Pictures, Inc. -334 U.S. 131 (1948) forced studios to vertically disintegrate and ended the practices of "block-booking" and "clearances," which were designed to guarantee screens to films.

It is also possible for film type to affect revenue in the predicted direction, but not through marketing investment. To address this issue, we implement separate two-stage and three-stage simultaneous estimation procedures (Heckman, 1979; Gulati and Nickerson, 2008). In the three-stage specification, we show that marketing investments fully mediate the impact of film type on box-office receipts (Shaver, 2005). This procedure is also discussed in greater detail below.

Data

The present study is based on a sample of movies distributed by the six major studios over a 15 year period, from January 1, 1994 to December 31, 2008. The start of this period was chosen to coincide with rise of the marketplace for American independent film.

We began by identifying the movies released theatrically by the six studios using *Variety* magazine's weekly box-office reports. These reports provide detail on the commercial performance of all domestic theatrical releases for a given week, including the number of screens on which the movie played and its distributor. For each film released by a major distributor, the first author gathered project-level details on its genre, director, cast, budget, producer, etc. from three main sources – *IMDb* (the Internet Movie Database at www.imdb.com), *Box Office Mojo* (www.boxofficemojo.com), and *The Hollywood Reporter* (www.hollywoodreporter.com).

The original sample was restricted to English language films that were not sequels and that were not released on a 'limited' basis in their first week of release.[9] Foreign language films were excluded because they might have different marginal returns with respect to marketing investments. Sequels were excluded for the same reason: prior marketing investments on the first film might change the marginal returns for the second and later films. Finally, as discussed below,

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[9] Films that are released in a 'limited' manner are exhibited on a few screens (under 20) during their first week but are then taken 'wide' to a few hundred or thousand screens in the several weeks following its initial release. Typically, this alternative release strategy is used to generate some initial word-of-mouth for a film or to qualify it for an Academy Award nomination.

'limited' release films were excluded due to the difficulty of measuring marketing investments for this sub-sample.

A total of 2016 movies meeting these criteria were released between 1994 and 2008. However, the sample itself is limited to 1520 movies for which we have complete financial and project-level data. The drop in observations is largely the result of missing film budget information for 24% of the population. There is no institution that maintains budget information for all films, and there is no law that compels producers to disclose the production costs of their projects (Sorenson and Waguespack, 2006; Natividad, 2009). In our dataset, 21.2% of the studio-financed films and 30.8% of independent films lack budget information. For both studio-financed and independent films, univariate tests reveal that the films with missing data received significantly lower marketing investments and achieved significantly poorer commercial performance than films in each category with valid budget information. Hence, the missing observations are economically less important that those included in the sample. Furthermore, the similarities in the missing observations across both sub-samples provided reassurance that the limited sample does not bias the tests in any systematic way.

Measures

Dependent Variables

As indicated, there is *a priori* reason to believe that marketing investments are complements of production investments in the revenue function for films. Essentially this means that, to reach their revenue potential, big-budget films require higher marketing investments than small-budget films. (If the revenue function were additive, then optimal production and marketing investments would be uncorrelated.) The multiplicative form of the revenue function in turn suggests a log-linear specification of the empirical tests. This is borne out by univariate analysis of the dependent variables, which shows the variance of outcomes increasing in both production and marketing investments. Accordingly, unless otherwise noted, all scalar variables are measured in logs (or more specifically, the logarithm after adding one to the scalar in order to

accommodate zero values). This is also consistent with specifications in prior work, for example, Elberse and Eliashberg (2003) and Gil (2009).

The present study examines the effect of vertical integration on two outcomes – *Marketing Investment* and *Commercial Performance*. We proxy marketing investment (which is not directly observable) using the logarithm of the number of screens on which the movie was released in its first week. This figure is published and recorded in film databases such as IMDb. As indicated, prior work has found that the number of opening screens for a movie is highly correlated with actual advertising expenditures (Sorenson and Waguespack, 2006; Elberse and Eliashberg, 2003).[10]

The *Commercial Performance* of a film is measured as the logarithm of gross box-office receipts earned through theatrical release in 1994 dollars. This figure is also published and recorded in databases. Apart from directly measuring a critical source of revenue, a film's box-office performance is also considered the primary driver of revenue from ancillary sources, such as DVD sales, television broadcast licenses, and film merchandising (Epstein, 2005).

Explanatory and Instrumental Variables

The main explanatory variable in this study is *Vertical Integration*, i.e., whether the film was studio-financed or independent. We follow Corts (2001) and define vertical integration as a binary variable that takes the value one when the parent company of the distributor is also the parent company of a production company listed for the film.[11] We identified the parent companies of the distributors and production companies by referring to the acquisitions and ownership history of different studios detailed in Natividad (2009) and through additional trade-

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[10] In the sample, 7.6% of the films were released in a 'limited' manner. For such films, the number of opening screens is not a good indicator of the marketing investments made by the distributor, and we exclude these films from the analysis. Nevertheless, if these films are included in the sample, the results remain the same.

[11] Corts (2001) defines an in-house films as "one for which the lead producer's parent company is also the parent company of the distributor." Corts notes that providing financing for the film secures a share of the copyright and that studios are often lead producers when they are listed as a production company. Goettler and Leslie (2005) also consider a studio to have an ownership stake in a given film whenever a studio division is listed as a production company on the project.

press searches. Specifically, the *Variety* charts from which we pull our sample lists the studio that distributed the film in the United States. We then refer to IMDb for a list of production companies credited for the movie's production.[12] *Vertical Integration* takes the value one when the studio distributing the film and a production company on the project share the same corporate parent, and zero otherwise. According to this measure, of the 1,520 films in the sample, 1,092 (71.84%) were produced in a vertically integrated manner, while 428 (28.16%) were independent.

Given the hypothesized complementarity between marketing and production investments, a second key explanatory variable is the *Production Cost* of the film. Although this cost is sunk when marketing investments are made, to the extent that production cost is correlated with potential revenue, it will affect marketing investments. In addition, as argued above, expected production cost may affect the choice between vertically integrated and independent production. We measure *Production Cost* as the logarithm of the film's budget. The budget of a film includes the salaries of the director, producer, cast and crew, as well as forecasts of the costs associated with film sets, special effects, and post-production editing. Budget information was extracted from multiple sources, including the IMDb, Box Office Mojo, and The Hollywood Reporter. As with box-office revenue, budgets are measured in 1994 dollars.

Producers play a key role in our strategy for obtaining a valid instrument to identify the direction of causality in our tests. We construct two measures of producers' past performance and experience. We focus on *individuals* credited with being a "producer" (rather than an "executive producer", "associate producer", "line producer", or "co-producer"). Unlike these other roles, it is the "producer" who actually shepherds the project forward by assembling its creative participants and script, raising money, coordinating production, etc. (Schwartz, 2011).

Producer Past Performance is measured as the logarithm of the average box-office performance of the producer of the project over his or her prior three films where he or she was a

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[12] IMDb collects and publishes the company credits of each film its database including the production companies involved in the project. IMDb permits companies to submit credit corrections to its database. An IMDb team evaluates the correction and takes action when necessary. As a result, there is good reason to believe that the credits displayed for a movie are accurate.

"producer". In the case of multiple producers, we take the average of the individuals' performance over their prior three films. *Producer Independent Experience*, is an indicator variable that denotes whether the movie's producers financed at least one of their previous three projects (where they were credited as a "producer") in an independent manner and secured theatrical release for it. A project's producers may not have financed any of their prior three films in an independent manner either because they are truly new filmmakers with no prior films; because they have only worked in alternative roles such as a line producer, associate producer, etc. in the past, but never as a full "producer"; or because they have only produced studio-financed films in their recent past.

Control Variables

We include a number of control variables in our tests. First, following prior work (Sorensen and Waguespack, 2006), we control for project characteristics including the *Genre* of the film (comedy, drama, action, etc.), whether the film was rated G or R by the MPAA (*MPAA Rating*), and the *Duration* of the movie, measured as the logarithm of its runtime. We also control for the quality of the main talent and scriptwriters involved in the project (Ravid, 1999). *Star Power* is measured as the logarithm of the average box-office revenue of the film's director and top five cast members, over their prior three films. *Writer Performance* is measured as the logarithm of the average commercial performance of the writers' previous three projects. Past work has also found that independently produced projects are more likely to involve greater *Artistic Stake*, where the director of the film is also its producer and writer (Fee, 2002). We measure *Artistic Stake* with an indicator variable for whether the film's director was also credited as a producer and writer.

Finally, we include controls for the *Season* in which the film is released (measured using Vogel's (2001) seasonality index ranging from 0 to 1), whether the film was produced entirely within the United States (*U.S. Production*), whether the distributor was a minor division within

the larger studio (*Minor Label*), and the movie's *Critical Rating* (measured as an aggregated critical review score ranging from 0-100% from www.rottentomatoes.com).[13]

Tables 1 and 2 report the definitions, summary statistics, and pair-wise correlations between the variables described above.

[Place Tables 1 and 2 about here]

Preliminary Results

OLS Models

We begin our analysis by presenting the results of OLS regressions where *Marketing Investment* and *Commercial Performance* are modeled as a function of *Vertical Integration* and our other control variables, including studio and year fixed effects.

[Place Table 3 about here]

Table 3 presents the results of our OLS analyses. Robust standard errors are reported in parentheses.[14] In the first column, *Vertical Integration* has a positive and significant coefficient (at the 1% level) in the model of *Marketing Investment*. Vertically integrated films obtain higher levels of marketing investment than independent films, but the reasons for this correlation are not clear. Several other independent variables are also significant: we discuss these later when we present the results of our multi-staged models.

In the second column, *Commercial Performance* is regressed on *Vertical Integration* and our control variables. The positive and significant coefficient of *Vertical Integration* (significant at the 1% level) provides evidence that studio-financed films do achieve higher commercial revenues.

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[13] Later as a robustness check, we include the number of past ties between the distributor and the principal creative participants as an additional control (Sorenson and Waguespack, 2006), and the results remain unchanged.

[14] While clustering standard errors by studio may appear appropriate in order to account for correlation of the error terms for movies released by the same studio, clustering is not advisable when there are only a few clusters (Angrist and Pischke, 2009). As a result, we compute robust standard errors in all our empirical models. Nevertheless, the significance of all our results remains unchanged if we compute standard errors clustered by studio.

Turning to the third and final column, *Commercial Performance* is modeled as in column two, but now *Marketing Investment* is included as an additional control. Both *Marketing Investment* and *Vertical Integration* have positive and highly significant correlation with *Commercial Performance* (at the 1% level). While the results of this table suggest that a relationship does exist between *Vertical Integration*, *Marketing Investments*, and *Commercial Performance*; it does not provide evidence of a causal relationship, let alone evidence of a mediation effect. We explore these questions in subsequent analyses.

Probit Models of Vertical Integration Choices

[Place Table 4 about here]

To determine whether movies with larger production costs are more likely to be financed by a studio than an independent source, we look to Table 4. This table presents the results of probit regressions where *Vertical Integration* is modeled as a function of project and producer attributes (but excluding *Marketing Investment*), with distributor and year fixed effects. Model (1) is the base model with only control variables. Here *Producer Past Performance* is positive and significant at the 1% level while *Minor Label* has a negative coefficient that is significant at the 1% level as well.

Model (2) includes the key independent variable, *Production Cost*. Including this variable increases the model's explanatory power, raising the pseudo R2 from 0.179 to 0.205. Supporting hypothesis H3, the coefficient on *Production Cost* is positive and significant at the 1% level, indicating that movie distributors are more likely to vertically integrate and finance large-budget projects. In addition, the inclusion of *Production Cost* reduces the significance of other explanatory variables. In particular, while Model (1) indicated that studio-financed projects tend to have significantly greater star power and more successful producers than independent films, these factors are only marginally significant after accounting for the higher production costs of studio-financed films.

In Model (3), we include *Producer Independent Experience*, an instrumental variable that we will use to establish the causal effect of vertical integration on marketing investments and commercial performance. Recall that *Producer Independent Experience* is an indicator variable that denotes whether the movie's producers financed at least one of their previous three projects independently and secured theatrical release for it. When this is the case, the film's producers are likely to have stronger relationships with investors outside the major studios in order to independently fund new projects, and as a result, may be less inclined to pitch the new project to a major studio. Alternatively, producers who have secured studio financing for three prior films may prefer studio financing and know how to package a project that is attractive to studio decision-makers. In either case, prior experience producing independently financed films increases the probability that the next project will be produced in an independent, rather than a vertically integrated manner. Consistent with this prediction, Model (3) shows that *Producer Independent Experience* has a negative coefficient that is significant at the 1% level.

Model 4 includes *Critical Rating* and *Season* as additional explanatory variables. This model contains all the explanatory variables that are included in the first-stage probit of the two- and three-stage models. We observe that *Critical Rating* has a positive coefficient that is marginally significant at the 10%, while *Season* is not significantly correlated with *Vertical Integration*. The significance of the other explanatory variables remains largely unchanged from Model (3).

Testing for Causality—Treatment Effects Models

As discussed above, to support the distinctive claims of property rights theory, it is necessary to establish a causal link between vertical integration and marketing investments (H1) and between marketing investments and commercial performance (H2a and b). Furthermore, the tests must account for the fact that vertical integration is endogenously determined and that there may be unobserved features of the film that simultaneously influence vertical integration, marketing investment and box office revenue. In this section, we focus on establishing the causal

effects of vertical integration on marketing investments and commercial performance, leaving the analysis of mediation for the next section.

Instrumental Variable and Controls for Unwanted Correlation

We estimate the treatment effect of vertical integration on marketing investment and commercial performance using Heckman's two-staged approach (Heckman, 1979), where the stages are estimated simultaneously using maximum likelihood. The execution of this approach requires at least one instrumental variable that is correlated with vertical integration (the outcome of the first stage), but not correlated with the error term of the second stage. As noted in the previous section, we use *Producer Independent Experience* as our instrumental variable. The results of the probit analysis in Table 4 indicate that this variable is significantly correlated with vertical integration. The F-statistic for *Producer Independent Experience* in the probit model was 12.04 (from Model (4)), surpassing the conventional threshold of 10 used to designate an instrument as relevant (Stock and Yogo, 2002).

 Absent controls, the past experience of the producer in making independent films might plausibly influence both marketing investments and commercial performance, creating unwanted correlation with the error term in the second stage. Specifically, some producers might consistently deliver films with positive quality shocks (η) or marketing returns (y), thereby deservedly garnering larger marketing investments and greater box-office success. The more talented producers (those with high ηs or ys relative to peers) might also be more (or less) likely have had past experience making independent films. Such uneven clustering could potentially create indirect correlation between the instrument and the error term in the second stage and thus invalidate our instrument.

To address this problem, we reasoned that systematic cross-sectional differences in producer quality should be discoverable by looking at the producers' recent track records. As indicated, *Producer Past Performance* measures the average box office revenue of the producers'

three prior films, thus can serve as a proxy for unobserved producer quality.[15] In the presence of this control, our instrument is less likely to be correlated with the errors in the second-stage models. Although the possibility of correlation through a common causal variable can never be completely ruled out, our specification controls for the most obvious source of indirect correlation between the instrument and the second-stage error.

A direct correlation between our instrument and marketing investments or commercial performance would arise if studios or audiences systematically favored or discriminated against producers based on their past experience. In that case, the producer's experience alone, not the his or her inherent quality or recent track record, would cause correlation, and our instrumental variable would be compromised. In fact Sorenson and Waguespack (2006) present evidence that studios overallocate resources to films involving people they have dealt with in the past. Below, in the section on robustness and alternative explanations, we address these concerns by switching instrumental variables and by including a control for past ties.

Results

[Place Table 5 about here]

Table 5 presents the results of our two-stage treatment effects models. Examining the results of the first stage, we see the coefficients in both models are virtually identical and consistent the one-stage probit model in Table 4. *Producer Independent Experience* continues to load negatively and significantly at the 1% level.

Turning to the second-stage results, we see that the treatment effect of *Vertical Integration* on *Marketing Investment* is positive and significant at the 1% level. Thus we have evidence that vertical integration increases the level of marketing investment distributors decide to make on

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[15] It is possible that some producers might deliver films with consistently higher revenue (high n) while others might generate higher returns on marketing investment (high y). To allow for the latter type, we constructed a variable that measured the average of the ratio of actual revenue to marketing investments for three prior films. This variable turned out to be highly collinear (70%) with *Producer Past Performance*, and thus we did not include it in our tests.

behalf of a film, supporting our first hypothesis, H1. Interpreting the economic significance of the result, we find that when a studio finances the film project, *it increases its marketing investments by approximately 120%*. Furthermore, Rho is negative and significant at the 5% level, indicating that endogenous selection is indeed a likely source of bias in a simple OLS regression of vertical integration on marketing investment.

Several control variables also have significant coefficients in the model of marketing investment. As expected, the coefficient on *Production Cost* is positive and is highly significant, indicating that more expensive films are marketed more heavily by distributors – this correlation is consistent with the view that there exist complementarities between marketing and production investments (Brynjolfsson and Milgrom, 2010). *Minor Label* has a negative and significant coefficient (at the 1% level) indicating that the smaller divisions within a studio spend less to market their films, after controlling for project-level attributes of the film. Consistent with prior work, we find that *Critical Rating* has a strong negative relationship with marketing investment (Elberse and Eliashberg, 2003). Lastly, the positive and significant coefficient of *U.S. Production* indicates that movies filmed within the United States receive larger marketing investments, possible because audiences are likely to be attracted to familiar settings.

Interestingly, although *Producer Past Performance* has a significant impact on the first-stage *Vertical Integration* outcomes, this variable does not have a significant effect on *Marketing Investment* in the second stage. One explanation for the absence of an effect is that on average the producer's track record affects the film's production budget and marketing investment to the same degree. In that case, after including *Production Cost* in the specification, the *Producer Past Performance* would have no incremental effect on marketing investment. Supporting this conjecture, in the OLS regression in Table 1, the coefficient on *Producer Past Performance* is insignificant after controlling for *Production Cost*.

The third and fourth columns of Table 5 present the second-stage results of the treatment effects model examining *Commercial Performance*. Consistent with hypothesis H2a, *Vertical*

Integration again has a positive coefficient that is significant at the 1% level. In economic terms, vertical integration causes the commercial performance of a film to increase by 81.3%. However, Rho is only weakly significant in this test. The endogenous selection of projects appears to be a weaker factor in the analysis of commercial performance than in the analysis of marketing investment.

Looking again at the control variables, we see that *Production Cost*, favorable critical reviews (*Critical Rating*), and releasing the film during a better season (*Season*) are all associated with higher revenues. Longer movies (*Duration*) and those produced within the U.S. (*U.S. Production*) also experience higher commercial performance. *Artistic Stake* has a negative and significant coefficient, indicating that movies where the director also serves as a producer and writer have lower revenue. *Minor Label* also has a strong negative relationship with film revenues, but its significance is due to the fact that we do not control for marketing investments in this model.

Conditional on the validity of our instrument, the results of Table 5 provide evidence that vertical integration does indeed have a positive causal effect on both marketing investments and commercial performance. What remains to be seen is to what extent the increased investment in marketing mediates the effect of vertical integration on commercial performance. In other words, does higher marketing investment drive the higher box office revenues observed for vertically integrated films? Or is the higher revenue obtained by some other route?

Test for Mediation — A Three-Stage Model

A three-staged approach is required to determine whether marketing investments mediate the effect of vertical integration on commercial performance (hypothesis H2b). As highlighted by Shaver (2005), estimates of mediation effects can be biased when the different steps of the mediation model are estimated independently of one another (as in the OLS results of

Table 3). Instead, mediation effects should be estimated using a system of equations, where the equations are estimated simultaneously. For the system of three equations to be identified, we need, first, a classic instrumental variable, and second, a variable that is a strong predictor of the potential mediating variable (i.e., marketing investment) that does not have a direct effect on the dependent variable in the third stage.

As our second instrument in the three-stage test, we use the indicator, *Minor Label*, which denotes whether the distributor of the film is a smaller division within the larger studio. Minor label divisions are likely to have fewer resources with which to market their films compared to larger divisions within each studio. Indeed, we saw in the treatment effects model that films distributed by minor labels have significantly lower marketing expenses after controlling for other film characteristics. At the same time, the fact that a film's distributor is a minor label is not something most consumers know, hence it is not likely to directly influence ultimate box office revenue.

Results

[Place Table 6 about here]

Table 6 displays the results of the three-stage analysis. Each column represents a different equation of the system. Notably, the coefficients for both the first and second stage estimates are very similar to those in the treatment effects model for *Marketing Investment* (the first two columns in Table 5). Adding a third stage and re-estimating the system of simultaneous equations does not significantly change the results of earlier tests.

The final column of Table 6 shows results for the third stage of the estimation procedure. Here *Commercial Performance* is modeled as a function of *Vertical Integration* and *Marketing*

Investment, plus other control variables. The instruments, *Producer Independent Experience* and *Minor Label* are omitted from this equation.

In the three-stage model, *Marketing Investment* has a positive and significant effect (at the 1% level) on commercial outcomes, but *Vertical Integration* no longer has a significant effect. Thus accounting for increased marketing investment essentially eliminates the effect of vertical integration on commercial performance.

To support the distinctive predictions of property rights theory, it would have been sufficient for the third-stage coefficient on *Vertical Integration* to fall relative to the two-stage treatment effects model (Table 5, Column 4), signaling that the effect of vertical integration was partially mediated by marketing investment. But in this case the third-stage coefficient on *Vertical Integration* is insignificant, indicating that the effect of vertical integration on commercial performance is *fully mediated* by marketing investments (Shaver, 2005; Baron and Kenny, 1986).

In summary, our three-stage model jointly tests the key predictions of property rights theory and (subject to caveats discussed below) obtains results that are consistent with theoretical predictions. In this setting, the expectation of higher marginal returns on vertically integrated films leads to higher levels of non-contractible marketing investment, and these higher levels of investment in turn give rise to superior economic performance. Furthermore, these concerns affect the vertical integration decision itself: films with higher production costs, which we have argued suffer disproportionately from reduced marketing investment are more likely to be selected for studio financing.

Robustness Checks, Alternative Explanations and Limitations

In this section we report the results of various robustness checks on our model specifications. We describe an alternative explanation of our results, based on past social ties (Sorenson and Waguespack, 2006), and show that controlling for past ties does not significantly

change our results. Finally we address a fundamental limitation of this study, the fact that we cannot observe marginal returns directly.

In our primary econometric tests, we did not cluster standard errors. Rerunning the tests with clustered standard errors did not change the results significantly. We also omitted films with an initial "limited" release. Our results are robust to including the limited-release films in the sample.

Both the two-stage treatment effects models and the three-stage model depend on the instrumental variable *Producer Independent Experience*. We have argued that, after controlling for producer quality (revealed by the producer's track record), studio vs. independent experience alone should not have an incremental effect on *Marketing Investment* or *Commercial Performance*. However, this assumption can be challenged. Thus to establish the robustness of our multi-stage results, we ran additional tests. In the first place, we reran our models using *Producer Past Performance* as our instrument and *Producer Independent Experience* as a control. In our tests, *Producer Past Performance* is a proxy for cross-sectional differences in producer quality. All of our tests indicate that it is highly correlated with *Vertical Integration* even after controlling for *Production Cost*. But after deciding whether to finance the film, how much to spend, and observing the film's quality, the producer's track record may have relatively little incremental impact on subsequent investment decisions and/or box office success. As a result, *Producer Past Performance* is an alternative instrumental variable for our analysis. Using *Producer Past Performance* as our instrumental variable and repeating our analysis, our results remain consistent. That is, we find that vertical integration significantly increases both marketing investments and commercial performance, and that the increase in commercial performance is mediated by the increase in marketing investments.

As another robustness test, we reran our analysis with both *Producer Independent Experience* and *Producer Past Performance* serving as instrumental variables. The benefit of using more than one instrumental variable is that we can now perform an over-identification to test for

the exogeneity of our instruments. When both *Producer Independent Experience* and *Producer Past Performance* are used as instrumental variables, our results regarding the effects of vertical integration remain the same. In the two-staged model for *Marketing Investments*, the over-identification test does not reject the null hypothesis that the instruments are exogenous (p-value is 0.35). Similarly, the p-value of the over-identification test after the two-staged model for *Commercial Performance* is 0.25 and again, we do not reject the null hypothesis that the instruments are exogenous.

A theoretical challenge to our models arises from prior work by Sorenson and Waguespack (2006). They suggest that distributors may be positively influenced by past social ties between the distributor and a film's "principals", defined as producers, writers, directors and actors. They go on to show that studios increase both production budgets and marketing investments in the presence of such ties. Sorenson and Waguespack do not measure vertical integration hence their tests do not control for differences in the distributors' marginal returns between studio-financed and independent films. If past ties are positively correlated with vertical integration, the impact of past ties on production budgets and opening screens might reflect real differences in marginal returns, and not a preference for dealing with familiar people. However, if studios have a true preference for past ties, and if our instrument, *Producers Independent Experience* happens to be correlated with this measure, there could be unwanted correlation between our instrument and the error terms of our second- and third-stage models.

To address this concern, we constructed a measure of past ties along the same lines as in Sorenson and Waguespack. Specifically, we calculate the logarithm of one plus the number of films the studio distributed of the project's writers, principal actors, director, and all its producers in the prior three years. The raw correlation between past ties and *Producer Independent Experience* was 0.036, indicating there is not cause for concern. We then reran our models, using *Producer Independent Experience* as the instrument, but including the measure of past ties as a control.

Table 7 presents our results. In both the two- and three-stage models our instrumental variable *Producer Independent Experience* continues to be significantly correlated with vertical integration at the 1% level (this can be seen in the first stage probit of the three-staged model). Interestingly, past ties between the distributor and the film's director, stars, writers and producers do not appear to have a major impact on *Vertical Integration* in the presence of the other explanatory variables.

The effects of vertical integration on marketing investment and commercial performance are also consistent with our earlier models: vertical integration positively affects both investment and performance, with the performance effect fully mediated by investment.

In both the two- and three-stage models, past ties are positively and significantly (*p<1%*) correlated with marketing investment. In other words, whether a film is studio-financed or independent, it will open with more screens if the distributor has past ties with the film's principals. We infer that, *ceteris paribus*, studios tend to spend more on marketing films with high past ties. This is consistent with Sorenson and Waguespack's results.

We also find that past ties are positively correlated with commercial performance. This stands in contrast to Sorenson and Waguespack's finding that, after controlling for production cost and marketing investment, past ties are negatively correlated with box office revenue. However, is possible that the negative coefficient on past ties in their test is an artifact of estimating three separate equations for endogenous variables rather than a simultaneous set of equations (Shaver, 2005). Another possibility is that our models allow the production cost of a film to influence marketing investments, while Sorenson and Waguespack do not consider a relationship to exist between these variables.

A limitation of our analysis is that we cannot measure the precise marginal returns of studio-financed films. Goettler and Leslie (2005) found that a significant minority of studio-financed films were co-financed and thus subject to complicated revenue splits between the distributor and other equity investors. Co-financing reduces the film's marginal returns to the

studio although co-financed films still generally have higher marginal returns than independent films. Thus pooling co-financed and solo-financed films (as we are forced to do) has the effect of reducing the difference in marginal incentives between the studio-financed and independent films in our sample.

Ideally we would like to measure precisely the studio's revenue share in each film. Instead we must make do with a categorical measure: marginal returns are either "high" (for vertically integrated films) or "low" (for independent films). We believe our dependence on a coarse measure of marginal returns reinforces, rather than compromises, our tests. Even with this imperfect measure, we obtain results that are (1) supportive of the predictions of property rights theory; (2) statistically significant; and (3) robust to alternate specifications. However, further testing with more precise data is a promising avenue of future research.

Conclusion

All formal statements of property rights theory are based on two critical predictions: first, that higher marginal returns will elicit higher levels of non-contractible investment; and second, that higher levels of non-contractible investment will increase project revenue (Grossman and Hart, 1986; Hart and Moore, 1990; Whinston, 2003; Antràs, 2003). From these predictions it follows that property rights should optimally be allocated to agents whose non-contractible investments obtain the highest marginal returns. This study contributes to the empirical literature on property rights by showing that both predicted linkages (from marginal returns to investment and from investment to revenue) exist in a single empirical setting.

The U. S. film industry is marked by having two distinct property rights regimes: studio-financed films are produced and distributed by studios which take in the lion's share of revenue. In contrast, independent films are distributed by studios under revenue sharing agreements, which give studios 30-40% of the revenue stream. Under either regime, the allocation of scarce marketing resources is determined by and paid for by the studio.

Studio-financed films thus offer higher marginal returns to marketing investments than independent films. A formal model based on property rights theory then yields the following predictions: (1) studios will underinvest in the marketing of independent films relative to studio-financed films; and (2) because of underinvestment, independent films will have lower revenues than comparable studio-financed films. Furthermore, (3) if production cost and marketing investment are complementary, underinvestment in marketing will harm large-budget films more than small-budget films, making it more likely that large-budget films will be studio-financed. Subject to caveats discussed in the previous section, our empirical tests support all three predictions.

We emphasize that these predictions differentiate property rights theory from Transaction Cost Economics (TCE). In determining the optimal ownership of different stages of production and the boundaries of a firm, TCE focuses on the parties' vulnerability to opportunism (in the presence of asset specificity, uncertainty, and frequency of transactions), but does not consider the impact of ownership on the parties' incentives to make non-contractible investments in upstream or downstream activities.

The distinctive predictions of property rights theory depend on envisioning the results of non-optimal behavior. Property rights—in theory and in practice—are allocated "in the shadow" of expectations of worse outcomes under alternative allocations. But the reliance on counterfactual reasoning creates challenges for empirical tests of the theory. Normally in any given industry, we expect to observe only the "best possible" allocation of property rights, because suboptimal allocations will be eliminated by optimizing behavior or by competition.

On rare occasions, however, we might be able to observe "suboptimal" behavior that sheds light on the operation of property rights theory and incentives. In the film industry, for example, there is (for some reason) a standard revenue-sharing agreement between studios and independent film owners. According to our best estimates, this revenue-sharing arrangement leads to suboptimal marketing of independent films. But if independent films are suboptimally

marketed relative to their studio-financed counterparts, why does the practice of revenue-sharing survive? As indicated, other contractual practices, most obviously the outright sale of a post-production film to a studio could remedy the misaligned marketing incentives of independent films. As a conclusion to this paper, we offer a possible explanation for the persistence of revenue sharing.

A seemingly suboptimal practice might be optimal if it is embedded in a larger set of negotiations. Thus recall that the rights to many studio-financed films are obtained from independent production companies in transactions before filming begins (at *t=0*). Revenue sharing reduces the value of independent films relative to studio-financed films at this point in time. Thus the practice of revenue sharing reduces the disagreement payoffs to independent producers when they are negotiating with studios over the sale of film rights. Put bluntly, for a production company at *t=0*, the value of "going independent" is lower if independent films are "second-class citizens" when it comes to marketing.

Under standard negotiations theory, a reduction in the disagreement payoffs to independent producers has two predicted effects: first, it reduces the amount the studio has to pay for film rights; and second, it increases the probability that an independent producer will opt for studio financing. These effects will be larger for the big-budget productions, which are more harmed by underinvestments in marketing. Thus the practice of revenue sharing, although it results in opportunity losses for some films, may in fact benefit studios overall by reducing the bargaining power of independent producers and making them more compliant in *ex ante* bargaining over film rights.

A related question is, why have studios "opened their doors" to independent films? This, we argue, can be explained by the fact that films are a "risky business." Much more is known about the quality and revenue potential of a film post-production than pre-production. For example, suppose a studio has acquired enough films *ex ante* to fill its distribution channels. It

would not want to pay to produce any more. However, *ex post*, film outcomes are highly variable: some films will have high realizations of $\hat{n}$, and some low.

If independent films exist "in the wild", a studio can inspect them (post-production). The studio can calculate the anticipated contribution from each of its own films and from the independent films under the revenue-sharing agreement. It can then select films with the highest contributions until its distribution channel is full. Given enough variability in *ex post* outcomes (a high enough S_n), the best independent films will have higher contributions than the worst studio-financed films, and the studio will benefit by swapping one for the other.

Thus independent film distribution to theatres can be seen as an institutional mechanism that allows studios to adapt to post-production information about the value of their own films vs. outside opportunities. This in turn justifies *ex ante* investment in the production of independent films (especially those with small budgets) despite their dampened revenue expectations.

Acknowledgements

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Table 1: Definition and Mean Values of Key Variables

Variable	Defintion	Mean		
		Vertically Integrated	Independent	T-test of Difference
Vertical Integration	A binary variable indicating whether the distributor of a film was also listed as a production company for the project			
Marketing Investment	The logarithm of the number of screens a movie was shown on in its first week of release	7.173	5.531	**
Commercial Performance	The logarithm of the total box-office gross of the movie at the end of its theatrical run (adjusted for inflation in 1994 dollars)	16.922	15.518	**
Critical Rating	A score from 0-100 obtained from Rotten Tomatoes (www.rottentomatoes.com) indicating the percentage of critics who recommended the movie to the public	46.731	47.521	
Prior Independence Experience	An indicator variable that denotes whether the movie's producers (i.e. the individuals that received the 'producer' credit) financed at least one of their previous three projects in an independent manner (i.e., without funds from a distributor) and secured theatrical release for it	0.487	0.591	**
Producer Past Success	The logarithm of the average box-office performance of the producers of the project, over their prior three films	15.603	13.132	**
Minor Label	An indicator variable for whether the distributor was a minor division within the larger studio (e.g., Miramax within Disney, or Focus Features within Universal)	0.177	0.428	**
Season	The degree to which a film a released during a high-attendence period of the year. This is measured using Vogel's (2001) seasonality index ranging from 0 to 1	0.638	0.636	
Production Cost	The logarithm of the film's budget (in 1994 dollars). The budget of a film includes the salaries of the director, producer, cast and crew, as well as forecasts of the costs associated with film sets, special effects, and post-production editing.	17.050	16.068	**
Star Power	The logarithm of the average box-office revenue of the film's director and top five cast members, over their prior three films.	16.822	15.742	**
U.S. Production	An indicator for whether the film was produced entirely within the United States	0.579	0.537	
Duration	The logarithm of the film's runtime in minutes	4.677	4.645	**
Writer Past Performance	The logarithm of the average box-office performance of the writers' previous three projects.	12.728	10.136	**
Artistic Stake	An indicator variable for whether the film's director was also credited as a producer and writer	0.130	0.145	
** indicates that the difference in means is significant at the 1% level				

Table 2: Summary Statistics and Pairwise Correlations (N = 1520)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Vertical Integration	1.000													
2 Marketing Investment	0.3439**	1.000												
3 Commercial Performance	0.3664**	0.7245**	1.000											
4 Critical Rating	-0.0135	-0.3090**	0.1050**	1.000										
5 Prior Independence Experience	-0.0936**	-0.0589*	-0.0654*	-0.0063	1.000									
6 Producer Past Success	0.2090**	0.3372**	0.2856**	-0.1338**	0.2488**	1.000								
7 Minor Label	-0.2615**	-0.6209**	-0.4885**	0.2122**	0.0696**	-0.2611**	1.000							
8 Season	0.0083	0.0308	0.0882**	0.0125	0.031	0.0235	-0.0185	1.000						
9 Production Cost	0.3680**	0.6555**	0.6503**	-0.1226**	0.0109	0.4218**	-0.5509**	0.0136	1.000					
10 Star Power	0.2081**	0.2847**	0.2527**	-0.0821**	0.0680**	0.2968**	-0.2640**	0.0289	0.4387**	1.000				
11 U.S. Production	0.0376	0.0233	0.0298	0.0547*	-0.0696**	-0.0163	-0.0346	0.0332	-0.1043**	0.0267	1.000			
12 Duration	0.0873**	0.0627*	0.2361**	0.2627**	0.1054**	0.1784**	-0.1052**	0.0024	0.3566**	0.1668**	-0.0906**	1.000		
13 Writer Past Performance	0.1548**	0.2522**	0.2740**	-0.0177	0.0055	0.2463**	-0.1886**	-0.0265	0.4067**	0.2279**	-0.0458	0.1804*	1.000	
14 Artistic Stake	-0.0196	-0.0830**	-0.0553*	0.1129**	0.0141	-0.0561*	0.0292	-0.0139	-0.0578*	-0.016	0.0363	0.1585*	0.0982**	1.000
Mean	0.718	6.711	16.527	46.953	0.516	14.907	0.247	0.637	16.773	16.518	0.567	4.668	11.998	0.134
Std. Dev.	0.450	2.149	1.725	26.428	0.500	5.320	0.432	0.133	1.201	2.334	0.496	0.167	7.535	0.341
Min	0.000	0.000	9.045	0.000	0.000	0.000	0.000	0.000	10.048	0.000	0.000	4.078	0.000	0.000
Max	1.000	8.322	20.137	100.000	1.000	19.127	1.000	1.000	19.037	18.248	1.000	5.442	19.112	1.000

Significance of correlation: * p<0.05 ** p<0.01

Table 3: OLS estimates for the effect of vertical integration on marketing investments and commercial performance

	OLS		
	Marketing Investment	Commercial Performance	Commercial Performance
Marketing Investment			0.488 **
			(0.0250)
Vertical Integration	0.452 **	0.400 **	0.180 **
	(0.0966)	(0.0840)	(0.0676)
Production Cost	0.737 **	0.690 **	0.331 **
	(0.0636)	(0.0569)	(0.0467)
Minor Label	-1.531 **	-0.783 **	-0.0360
	(0.146)	(0.113)	(0.0891)
Critical Rating	-0.0110 **	0.0168 **	0.0222 **
	(0.00156)	(0.00133)	(0.00116)
Season	0.0666	0.635 **	0.603
	(0.281)	(0.212)	(0.176)
Star Power	-0.0294	-0.0334	-0.0191
	(0.0215)	(0.0230)	(0.0183)
Duration	-0.119	0.644 **	0.703 **
	(0.285)	(0.243)	(0.202)
Writer Past Performance	-0.00105	0.00250	0.00301
	(0.00523)	(0.00465)	(0.00370)
Producer Past Performance	0.0108	0.00321	-0.00206
	(0.00813)	(0.00734)	(0.00581)
U.S. Production	0.353 **	0.276 **	0.103 +
	(0.0751)	(0.0634)	(0.0526)
Artistic Stake	-0.157	-0.227 *	-0.151 +
	(0.117)	(0.0955)	(0.0802)
MPAA Rating Controls	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Constant	-4.915 **	1.024	3.421 **
	(1.264)	(1.118)	(0.943)
Adjusted R^2	0.615	0.563	0.705
N	1520	1520	1520

Robust standard errors in parentheses

+ $p<0.10$ * $p<0.05$ ** $p<0.01$

Table 4: Vertical integration choices of movie distributors (probit)

	Vertical Integration			
	(1)	(2)	(3)	(4)
Critical Rating				0.00286 +
				(0.00168)
Season				-0.117
				(0.279)
Producer Independent Experience			-0.289 **	-0.288 **
			(0.0828)	(0.0830)
Production Cost		0.363 **	0.359 **	0.371 **
		(0.0611)	(0.0608)	(0.0616)
Star Power	0.0682 **	0.0338	0.0353 +	0.0355 +
	(0.0208)	(0.0206)	(0.0204)	(0.0203)
Duration	0.582 *	-0.267	-0.254	-0.424
	(0.284)	(0.311)	(0.310)	(0.326)
Writer Past Performance	0.00858	0.00112	0.000343	0.000134
	(0.00527)	(0.00554)	(0.00558)	(0.00558)
Producer Past Performance	0.0276 **	0.0136 +	0.0224 **	0.0229 **
	(0.00735)	(0.00774)	(0.00816)	(0.00819)
Artistic Stake	0.0520	0.159	0.176	0.173
	(0.110)	(0.117)	(0.117)	(0.117)
Minor Label	-0.577 **	-0.308 **	-0.271 *	-0.296 **
	(0.0985)	(0.111)	(0.111)	(0.113)
U.S. Production	0.136 +	0.199 *	0.190 *	0.189 *
	(0.0793)	(0.0802)	(0.0808)	(0.0810)
MPAA Rating Controls	Yes	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Constant	-3.156 *	-4.422 **	-4.412 **	-3.874 **
	(1.355)	(1.411)	(1.399)	(1.429)
Pseudo R^2	0.179	0.205	0.212	0.213
N	1520	1520	1520	1520

Robust standard errors in parentheses

+ $p<0.10$ * $p<0.05$ ** $p<0.01$

Table 5: Results of treatment effects models for the effect of vertical integration on marketing investments and commercial outcomes

	Treatment Effects Model for Marketing Investments		Treatment Effects Model for Commerical Performance	
	Vertical Integration (1st Stage)	Marketing Investments (2nd Stage)	Vertical Integration (1st Stage)	Commercial Performance (2nd Stage)
Vertical Integration		0.791 **		0.595 **
		(0.186)		(0.138)
Producer Independent Experience	-0.286 **		-0.288 **	
	(0.0825)		(0.0827)	
Production Cost	0.367 **	0.701 **	0.370 **	0.669 **
	(0.0625)	(0.0631)	(0.0624)	(0.0567)
Minor Label	-0.309 **	-1.496 **	-0.302 **	-0.762 **
	(0.112)	(0.144)	(0.113)	(0.111)
Critical Rating	0.00261	-0.0113 **	0.00290	0.0167 **
	(0.00168)	(0.00155)	(0.00168)	(0.00131)
Season	-0.126	0.0799	-0.117	0.643 **
	(0.280)	(0.279)	(0.278)	(0.210)
Star Power	0.0362 +	-0.0329	0.0369 +	-0.0354
	(0.0207)	(0.0213)	(0.0209)	(0.0229)
Duration	-0.406	-0.0720	-0.432	0.672 **
	(0.325)	(0.281)	(0.326)	(0.239)
Writer Past Performance	0.000174	-0.00111	0.0000808	0.00246
	(0.00556)	(0.00517)	(0.00558)	(0.00459)
Producer Past Performance	0.0234 **	0.00916	0.0232 **	0.00226
	(0.00815)	(0.00804)	(0.00819)	(0.00723)
U.S. Production	0.197 *	0.338 **	0.194 *	0.267 **
	(0.0810)	(0.0741)	(0.0811)	(0.0625)
Artistic Stake	0.168	-0.167	0.172	-0.233 *
	(0.117)	(0.116)	(0.117)	(0.0941)
MPAA Rating Controls	Yes	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Constant	-3.889 **	-4.728 **	-3.844 **	1.131
	(1.424)	(1.248)	(1.434)	(1.103)
Rho		-0.152 **		-0.103 +
		(0.0727)		(0.0596)
X^2		1941.7		1504.7
N	1520	1520		1520

Robust standard errors in parentheses

+ p<0.10 * p<0.05 ** p<0.01

Table 6: Three-staged model to examine of the joint effects of vertical integration and downstream marketing investments on commercial outcomes

	3-Staged Model Estimated Simultanenously		
	Vertical Integration (1st Stage)	Marketing Investments (2nd Stage)	Commercial Performance (3rd Stage)
Marketing Investment			0.512 **
			(0.0570)
Vertical Integration		0.793 **	0.156
		(0.210)	(0.169)
Minor Label	-0.309 **	-1.495 **	
	(0.112)	(0.145)	
Producer Independent Experience	-0.286 **		
	(0.0827)		
Production Cost	0.367 **	0.701 **	0.314 **
	(0.0628)	(0.0638)	(0.0692)
Critical Rating	0.00260	-0.0113 **	0.0225 **
	(0.00173)	(0.00155)	(0.00138)
Season	-0.126	0.0800	0.601 **
	(0.280)	(0.279)	(0.175)
Star Power	0.0362 +	-0.0329	-0.0182
	(0.0209)	(0.0213)	(0.0180)
Duration	-0.405	-0.0717	0.704 **
	(0.328)	(0.281)	(0.201)
Writer Past Performance	0.000177	-0.00111	0.00303
	(0.00557)	(0.00517)	(0.00365)
Producer Past Performance	0.0234 **	0.00915	-0.00226
	(0.00816)	(0.00806)	(0.00573)
U.S. Production	0.197 *	0.338 **	0.0951 +
	(0.0810)	(0.0742)	(0.0556)
Artistic Stake	0.168	-0.167	-0.146 +
	(0.117)	(0.116)	(0.0806)
MPAA Rating Controls	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Constant	-3.890 **	-4.727 **	3.534 **
	(1.422)	(1.249)	(1.055)
X^2		324.1	
N		1520	

Robust standard errors in parentheses

+ p<0.10 * p<0.05 ** p<0.01

Table 7: Results of two-staged and three-staged models with distributor past ties as an additional covariate

	Treatment Effects Model (2nd Stage)		3-Staged Model Estimated Simultenously		
	Marketing Investments	Commercial Performance	Vertical Integration (1st Stage)	Marketing Investments (2nd Stage)	Commercial Performance (3rd Stage)
Marketing Investments					0.517 **
					(0.0561)
Vertical Integration	0.740 **	0.553 **		0.745 **	0.138
	(0.180)	(0.135)		(0.203)	(0.164)
Minor Label	-1.513 **	-0.779 **	-0.305 **	-1.512 **	
	(0.143)	(0.110)	(0.112)	(0.144)	
Producer Independent Experience			-0.291 **		
			(0.0829)		
Distributor Past Ties	0.109 **	0.115 **	0.0652	0.109 **	0.0590 *
	(0.0377)	(0.0306)	(0.0397)	(0.0377)	(0.0259)
Production Cost	0.675 **	0.641 **	0.347 **	0.675 **	0.295 **
	(0.0639)	(0.0572)	(0.0633)	(0.0645)	(0.0678)
Critical Rating	-0.0111 **	0.0169 **	0.00277	-0.0111 **	0.0227 **
	(0.00153)	(0.00130)	(0.00173)	(0.00154)	(0.00136)
Season	0.0684	0.631 **	-0.124	0.0685	0.595 **
	(0.278)	(0.210)	(0.281)	(0.278)	(0.175)
Star Power	-0.0350 +	-0.0377	0.0343 +	-0.0350 +	-0.0193
	(0.0212)	(0.0230)	(0.0207)	(0.0212)	(0.0180)
Duration	-0.0352	0.712 **	-0.366	-0.0346	0.726 **
	(0.277)	(0.236)	(0.325)	(0.278)	(0.200)
Writer Past Performance	-0.00238	0.00112	-0.000792	-0.00238	0.00235
	(0.00520)	(0.00456)	(0.00557)	(0.00520)	(0.00364)
Producer Past Performance	0.00673	-0.000342	0.0221 **	0.00671	-0.00369
	(0.00807)	(0.00727)	(0.00823)	(0.00809)	(0.00578)
U.S. Production	0.332 **	0.260 **	0.189 *	0.332 **	0.0896
	(0.0736)	(0.0620)	(0.0808)	(0.0737)	(0.0552)
Artistic Stake	-0.163	-0.229 *	0.167	-0.163	-0.144 +
	(0.116)	(0.0940)	(0.117)	(0.117)	(0.0805)
MPAA Rating Controls	Yes	Yes	Yes	Yes	Yes
Genre Controls	Yes	Yes	Yes	Yes	Yes
Distributor Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes +
Constant	-4.539 **	1.336	-3.813 **	-4.537 **	3.668** **
	(1.243)	(1.106)	(1.418)	(1.243)	(1.051)
Rho	-0.089	-0.137 +			
	(0.0575)	(0.0699)			
X^2	1577.6	2006.57		330.16	
N	1520	1520		1520	

Robust standard errors in parentheses

+ p<0.10 * p<0.05 ** p<0.01