Cofinancing to Manage Risk in the Motion Picture Industry[†]

Ronald L. Goettler
Tepper School of Business
Carnegie Mellon University
ronald.goettler@cmu.edu

Phillip Leslie
Graduate School of Business
Stanford University
pleslie@stanford.edu

Abstract

Cofinancing is a term used in the movie industry to describe films for which multiple firms share the cost of production and revenues. We find that one-third of movies produced by major studios between 1987 and 2000 are cofinanced. Anecdotal evidence strongly indicates that cofinancing is for the purpose of risk management. However, the major studios are publicly traded firms, which allows investors to make their own diversification decisions, leading us to question the importance of cofinancing for risk management. Contrary to industry-claims, we find that cofinancing decisions are unrelated to the distribution of individual movie returns—studios do not appear to cofinance relatively risky films. But we do find that studios are more likely to cofinance movies that account for a large fraction of their total annual production budget, which reduces portfolio risk via the law of large numbers. Toward an alternative explanation for cofinancing, we also find that cofinancing between two major studios impacts the release dates of their other movies.

This version: August, 2004

[†]We thank Lanier Benkard, Liran Einav, Mark Manusak, Chuck Moul, Peter Reiss and Alan Sorensen for helpful advice. We also thank the anonymous referees and coeditor for many helpful suggestions.

1 Introduction

Cofinancing is a term used in the movie industry to describe films for which multiple firms share the cost of production and revenues.[1] At its peak in 1995, 35% of movies produced by the major studios were cofinanced, accounting for 42% of studios' total production costs in that year. A leading example is the hugely expensive and successful movie *Titanic*, which was jointly owned by two competing major studios: Fox and Paramount. The conventional wisdom in the movie industry is that cofinancing is for the purposes of risk management. However, risk averse behavior by public firms, as the studios are, is in contrast to standard models in which firms produce to maximize expected profits and investors choose portfolios of equity in multiple firms to obtain their utility maximizing trade-off between expected returns and uncertainty.[2] The goal of this study is to evaluate whether studios have used cofinancing to mitigate their exposure to risk.

There is no question that financial risk is a primary characteristic of the motion picture industry—demand is notoriously difficult to predict and nearly all costs are incurred before any demand is realized. This feature has led to a variety of film financing arrangements, as described in Cones (1998). Some authors, such as Desai, Loeb, and Veblen (2002), have even suggested that financing strategy is the key variable that shapes the industry. We construct a dataset to analyze the extent of cofinancing and potential reasons for this financing strategy. We find that about one-third of studio-made movies between 1987 and 2000 were cofinanced.

There are three ways that cofinancing could reduce the risk associated with the financial returns on studios' movie investments. First, studios could cofinance relatively risky films, shifting the weight of their investments to less risky projects. This is the reason for cofinancing that is usually proposed by industry-insiders. However, we show that the empirical distribution of return on investment for cofinanced films is identical to the distribution for studios' solo-owned films. This reveals that studios are not in fact cofinancing relatively risky movies. Moreover, this conclusion is robust to any definition of risk that is related to the distribution of returns for a film, and it is irrelevant that studios may rely on private information when deciding whether to cofinance a film.

A second way that cofinancing could reduce studios' risk, is by allowing them to fine tune

[1] In other words, cofinancing is synonymous with co-ownership or equity-partnership, however cofinancing is the term used in the industry.

[2] Risk averse firm behavior is often explained by agency issues with risk averse managers. For example, see Lambert (1986).

their portfolios, taking advantage of covariances in the returns across movies. For example, a studio may want to cofinance a film whose return is correlated with the other movies already in its portfolio. Casting doubt on this motivation for cofinancing, we find that there are insignificant covariances in the revenues of movies of different types.

A third way for cofinancing to reduce risk, is via the law of large numbers. As we show in Section 4, if all films have identically distributed ROI, the variance of ROI for a portfolio of solo-financed films is double the variance when the studio takes half-ownership of twice as many films. However, under this scenario, cofinancing two big budget films is equivalent to sole-ownership of two films with half the budget. Hence, cofinancing is a *necessary* tool for risk management via the law of large numbers only if big budget movies tend to yield a higher ROI than small budget movies. We show that, in fact, the opposite is true. However, under the assumption that studios have a preference for making big budget movies, cofinancing these expensive movies will indeed reduce the riskiness of the overall portfolio. To this end, we show that studios are more likely to cofinance movies that account for a large fraction of their total annual production costs.

The finding that studios are more likely to cofinance large annual cost share films relative to small annual cost share films, reveals that studios are indeed managing the riskiness of their portfolios by cofinancing. But we are still only able to explain a small fraction of the variation in which films are cofinanced. This fact, combined with our finding that the empirical distributions of returns are the same for cofinanced and solo-owned films, leads us to suspect there are other major determinants of studios cofinancing choices, unrelated to risk. We present evidence supporting an alternative explanation—unrelated to risk—for cofinancing between major studios. We show that when a major studio cofinances with another major studio, they release their movies further apart from one another. This suggests one possible reason to cofinance among major studios is to soften competition with respect to release dates.

Most prior empirical studies of the movie industry focus on aspects of consumer demand for films.[3] A few previous papers analyze the behavior of firms in the industry, as we do here. Fee (2002) shows that films are more likely to be independently financed, rather than financed by a major studio, when control over the movie is more important to the producer. As Fee explains, the findings support the hypothesis that outside equity control has costs in addition to any monitoring benefits. A paper which bears similarities to our analysis of the effect of

[3]Studies of this kind include De Vany and Walls (1996, 1997, 1998, 2000), Einav (2003a), Moul (2003a and 2003b), Neelamegha and Chintagunta (1999) and Sawhney and Eliashberg (1996).

cofinancing on release dates is Corts (2001) study of the impact of vertical structure on release dates. Chisholm (2000) and Einav (2003b) both study the strategic competition between studios over release dates. Ravid (1999) shows that casting movie stars does not increase the mean return on investment, once production budget is also taken into account. Ravid and Basuroy (2004) find that films featuring sex and violence tend to have lower variance in returns, and argue that this makes such movies appealing to risk averse studio managers.

The remainder of our paper is organized as follows. In Section 2 we summarize the data, explain our approach for identifying which films are cofinanced, and present descriptive statistics concerning the extent of cofinancing. Section 3 contains our analysis of the distributions of returns for movies, conditional on being cofinanced or solo-owned. In Section 4 we examine cofinancing for the purpose of managing risk at the portfolio level. Cofinancing to reduce risk of big budget movies is explored in Section 5, which also includes our analysis of the effect of cofinancing by two major studios on release dates. Section 6 concludes the paper.

2 Data Summary

This section is divided into three subsections. In the first subsection we describe the sources of our data and outline our approach to measuring movie profitability. In the second subsection we explain how we determine which films are cofinanced, and present summary statistics on the extent of cofinancing. The third subsection contains a description of which types of movies are cofinanced.

2.1 Data Description

Our data cover all 3,826 movies exhibited in the US on at least five screens during the period 1987 to 2000.[4] The primary source of data is the Internet Movie Database (IMDb), which is accessible on the internet at www.imdb.com. The IMDb database is particularly useful in providing movie characteristics (production company, distribution company, genre, actors, director, etc). We supplement the IMDb data with box office and budget information from the firm ACNielsen-EDI, and with video rental revenue data from *Video Store Magazine*.[5]

[4] We exclude adult movies.

[5] We are grateful to Julie Mortimer for providing us with the video revenue data.

Our analysis focuses on ownership choices of the major studios. Of the 3,826 movies in the dataset, 1,305 are produced by the major studios. Table 1 provides summary statistics of the main variables for these 1,305 films. All dollar-denominated variables are adjusted to 1996 dollars. The variable "No. Stars", in Table 1, refers to the number of people in the film who either (i) acted with top 4 billing in more than 12 films earning $5 million or more in US box office since 1970, or (ii) directed, produced, or wrote more than 20 films earning $5 million or more, since 1970. Based on this criteria, we identify 132 stars in our dataset. The variable "No. Equity Firms" refers to the number of firms with an equity-stake in the movie. We distinguish these firms according to whether they are one of the "Big 8" major studios—Columbia, Disney, DreamWorks, MGM, Paramount, Universal, Warners, and 20th Century Fox. The remaining variables in Table 1 are self-explanatory.

We measure movie profitability based on return on investment, ROI, defined as revenue divided by cost, where revenue is measured as North American box office revenue and cost is the production budget.[6] We use a standard measure of production cost, often referred to as a film's negative cost. While our measure of cost excludes some costs, such as advertising, Ravid and Basuroy (2004) show these costs to be proportional to production cost. Hence, our measure of ROI allows us to evaluate relative profitability of films, but not absolute profitability.

Our measure of revenue excludes certain revenues, such as video revenue and foreign box office. While using all revenue sources would be ideal, such an approach would limit the number of films used in the analysis, since these data are only available for a subset of films. Even more concerning is the likelihood that limiting the analysis to films for which these other revenue sources are available would introduce selection bias, because these data are more likely to be available for those films that were successful. As long as US box office revenue is highly correlated with the total revenue from other sources, then our approach should be informative. We observe foreign box office revenue for 784 films and video rental revenue for 1,353 films. We find that US box office explains 90% of the variation in foreign box office, and 78% of the variation in the video revenue. In the analysis below, our findings are robust to whether we use the full sample using only US box office as the measure of revenue, or the smaller samples using foreign or video revenue.

[6] As is common practise, we use the term US box office to refer to North American box office. Also, see Ravid (1999) for a more detailed discussion of using revenue divided by production cost to measure relative movie profitability.

2.2 Identifying Cofinanced Films

As mentioned in the introduction, cofinancing is a term used in the movie industry to refer to the joint-ownership of movies.[7] We observe the identities of all designated "production companies" for each film. To be listed as a production company for a movie is a necessary but not sufficient condition for being a cofinancing partner. The essential criteria is whether a firm contributes equity toward the production cost. A firm can be credited with being a production company for a film due to the fact that it had initiated the project and then sold it to a major studio for production, without retaining any share of the revenues. This commonly arises as part of a longer-term relationship between a studio and a semi-independent production company, sometimes referred to as a "first-look deal".[8]

We determine which firms are cofinancing partners using the following criteria.[9] First, whenever a major studio is listed as a production company for a film, we assume that studio has an ownership stake in the movie.[10] Second, *Variety* magazine provides a listing of "Facts on Pacts" that distinguishes firms with first-look deals from firms that are equity partners.[11] If a firm is listed as a production company on a movie and is listed as an equity partner by *Variety*, we assume the firm is a joint owner. We also searched *Variety* for additional evidence of whether specific firms contribute equity financing to movies and we verified cases that remained unclear with industry executives.[12] Note that our dataset provides no information about the split of equity among cofinancing partners. Anecdotal evidence indicates equal shares for the co-owners is the norm.[13]

For movies that are cofinanced by a major studio with an independent firm, there is a question as to whether the studio had the option of being sole-owner or whether the independent firm had the option of being sole-owner. In other words, which firm initiated the project? The only information we have been able to uncover concerning this is based on conversations with studio

[7] A closely related concept is split-rights deals, in which different firms have 100% ownership of different revenue sources. For the purpose of our study we do not distinguish split-rights deals from cofinancing.

[8] Cones (1998) describes first-look deals in more detail, as well as other film financing and production arrangements.

[9] We are particularly grateful to Alan Horn (President of Warners) and Steve Spira (head of Warners' business department) for helping us identify which production companies contribute equity.

[10] The data distinguishes a studio as a production company from a studio as a distributor. If a studio is listed only as a distributor, we do not consider it to be a cofinancing partner on the movie.

[11] See *Daily Variety*, June 26, 2001, p.18.

[12] We have the impression from talking to people in the industry that it is quite clear to them which firms provide financing for movies and which firms participate as movie producers without providing financing.

[13] A prominent exception to this norm is the movie *Titanic* for which half the revenues were sold for approximately one-third of the production cost.

executives. The answer is that, typically, the studio is in the position of deciding whether it will be sole-owner or part-owner of a movie. This decision is generally also made at the time of deciding whether to make the movie (the so-called "greenlighting" decision).

A complication arises when two firms from the same subsidiary structure (i.e., have the same parent company) share the ownership of a movie. In these cases we assume the movie is not cofinanced, which is consistent with Corts (2001) who presents evidence that production divisions behave as integrated components of their parent studio, rather than as competitors.

Another issue concerns star actors or directors who negotiate a share of the movie's revenues. We ignore this form of joint-ownership. There are a couple of reasons why this may be reasonable. First, the kind of cofinancing we have in mind is where another firm takes a significant share of ownership in a movie, usually 50%. While there are examples of top-shelf talent, such as Tom Cruise, Tom Hanks and Steven Spielberg, obtaining 15% or more of first-dollar gross, such deals are typically for less than 5%.[14] Second, movie executives appear to distinguish cofinancing with other firms from giving revenue shares to actors/directors. The latter seems to result from the strong bargaining power of particular actors/directors, rather than any desire of the studio to manage risk (or influence release-dates).

The above procedure identified 361 movies that were cofinanced between a major studio and an independent firm and 32 movies that were jointly owned by two major studios.[15] The remaining 912 movies between 1987 and 2000 were solo-owned by a studio.[16] Figure 1 depicts various time-series for the number of movies released each year, by different types. Total number of US theatrical releases has been rapidly increasing through the 1990s, from around 250 to 340 films per year over that time. The graph also shows a sudden jump in 1995 in the number of films with multiple producers listed, although this is not necessarily a jump in cofinancing, since not all production labels contribute equity. The number of movies per year involving a major studio as a producer declined in the second half of the 1990s, even though the number of big budget movies (cost exceeding $40 million) has been steadily rising. This implies studios have reduced the number of low budget movies they produce, over this period. Figure 2 shows the time-series for the number of films that are cofinanced. The mid-to-late 1990s saw a rise in the number of cofinanced movies, peaking in 1996 at 87 films, 49 of which involved a major studio. The number of solo-produced films by major studios has been falling since 1993.

[14] For a good description of revenue-sharing by actors/directors see the article titled "Pic Biz Learns Gross Anatomy" in *Variety*, February 8, 1999.

[15] There are no movies cofinanced by more than two major studios.

[16] The remaining 2,521 movies in our dataset were fully financed by independent firms.

The extent of cofinancing varies considerably across studios as well over time for a given studio. This is shown in Figure 3 which plots the fraction of films cofinanced each year by each studio. Warners, for example, increased the fraction of cofinanced movies from about 10% in 1987 to over 70% in 2000. The extent of cofinancing at Fox is more variable over time, jumping from less than 10% one year to almost 40% the next and then back to less than 10% the following year. Note also Disney's high degree of cofinancing in the late 1980s, with 100% of movies being cofinanced in 1987. During this period, Disney (or its subsidiaries, such as Touchstone Pictures) cofinanced many movies with Silver Screen Partners.

2.3 Characteristics of Cofinanced Films

In this subsection we present correlations between observed movie characteristics and whether each film is cofinanced. This is intended as a purely descriptive exercise, rather than an attempt to identify causal effects. Nevertheless, it is interesting to examine whether studios appear more likely to cofinance films with particular characteristics.

Table 2 shows mean characteristics of pictures that are solo-owned, cofinanced by a major studio with at least one independent firm, or cofinanced by two major studios. One might expect that big budget films would tend to be cofinanced, however Table 2 provides conflicting evidence. On the one hand, studios tend to cofinance big budget movies with other major studios—$62 million in the average budget of multi-studio films versus $31 million for solo-studio films. On the other hand, there is little difference in average budgets of movies that are solo-owned with the movies that are cofinanced with an independent firm.

While the mean ROI for solo-owned movies is higher than for movies cofinanced with an independent, the difference in terms of median ROI is less, indicating that high ROI outliers exist in the set of movies that are solo-owned. Cofinanced movies tend to have more stars and are less likely to be comedies, but are almost identical in every other respect. For movies cofinanced by two major studios, the mean ROI is about the same as for other cofinanced films. However, median ROI is somewhat higher for multi-studio films than for all other movies. Multi-studio movies are also more likely to be action movies and less likely to be comedies, than other studio movies.

Table 2 shows conditional means of each variable, and the question arises as to which of these variables would have statistical significance in a multivariate analysis of the determinants of

cofinancing. In Table 3 we present the results for three separate probits in which the dependent variable is the probability that a movie is cofinanced and the right hand side variables are budget, genre and ratings dummies.[17] In the first column of Table 3 the dependent variable is the probability that a studio-made movie is cofinanced with an independent. Several of the coefficients are statistically different from zero, including several different genres. However, $log(budget)$ is not significant, as we expected from Table 2.[18]

In the second column of Table 3 the dependent variable is the probability of cofinancing by two major studios. In contrast to the first column, budget is now highly significant, and all other estimated coefficients are insignificantly different from zero. In the third probit reported in Table 3 we pool cofinancing between two studios with cofinancing between a studio and an independent firm. The results are similar to the first probit, as expected since most cofinanced films are with an independent. A possible explanation for why budget appears to be an important factor in multi-studio cofinancing, but not in cases of cofinancing with independents, is that cofinancing with major studios is driven by risk considerations, while cofinancing with independents is driven by a demand for creative inputs from the independent.[19] An alternative explanation is that other major studios are the only ones willing to participate in big budget movies, since for independents it would require too much of their capital to be a joint a joint-owner.

While several of the estimated coefficients in the probit for any combination of cofinancing (3rd column of Table 3) are significant, it is noteworthy that these characteristics explain only a small fraction of the variation in which films are cofinanced. An intuitive method for evaluating the predictive power of this specification is to compare the predicted conditional probability of each movie being cofinanced from the probit, with the unconditional probability of any movie being cofinanced (i.e. 393/(912+393) = .30). Specifically, if the predicted conditional probability is greater than .30, we say the movie is predicted to be cofinanced.[20] Of the 912 movies that were solo-owned by a studio, we correctly predict only 495 of them will be solo-owned, while incorrectly predicting 417 to be cofinanced. Similarly, of the 393 movies that were in fact cofinanced, the model incorrectly predicts 163 would be solo-owned.

We conclude that the observed movie characteristics are fairly uninformative in terms of

[17] We also exclude number of stars as this is highly collinear with budget. The excluded genre is drama and the excluded ratings-category is R.

[18] The result is unchanged if $log(budget)$ is replaced with $budget$.

[19] We thank a referee for suggesting this possible explanation.

[20] This approach may overstate how well our model fits the data, since it does not distinguish between a movie for which the predicted conditional probability is .31 and another movie for which this probability is .99. However, this is inconsequential since we show the model fits poorly.

predicting which films are likely to be cofinanced by the studios. On the one hand it is not surprising that studios would make cofinancing decisions based on information that is unobserved to us. On the other hand, we expect that any variables that are informative about the distribution of ROI for a movie, would also be useful in deciding whether to cofinance a movie. This assumes that cofinancing decisions are somehow related to the distribution of ROI for each movie. The question therefore arises: is the data informative about the distribution of ROI for each movie?

In an unreported regression, we regress ROI on: cost, log of cost, cost-squared, number of stars (defined above), genre dummies, ratings dummies, year dummies, studio dummies and a constant. Many of the coefficients are significantly different from zero, and the R-squared is 0.15 (adjusted R-squared is 0.12).[21] Hence, the observed variables explain over 10% of the variation in movie ROI. To assess whether the same variables help to predict the variance in ROI, we regress the squared residuals from this ROI regression on the same set of variables (i.e., we estimate a heteroskedastic function). For this specification, the R-squared is 0.19 (adjusted R-squared is 0.17). Hence, the observed data is even more informative for predicting the variance in ROI for each film.

Of course, there may be factors related to ROI that are observed by the studios, but not by us. In the next section we propose a test for whether studios cofinancing decisions are based on the distribution of ROI for each movie, that allows for the possibility that studios possess private information. This is important, since the data summary in this section indicates that cofinancing decisions are not primarily related to the information we have available to us.

[21] Adding in dummies for each of the 132 stars, as defined above, increases the R-square to 0.24 (adjusted R-squared to 0.14).

3 Cofinancing High Risk Movies

> "It's safe to say that all studios are now interested in risk management and are willing to give up some upside for covering the downside encountered over a full schedule of movies ... Studios try to exclude what they think are sure shots and only share risk on things that are not. But every now and then, something that didn't feel like a sure shot becomes a blockbuster. And sometimes what was thought to be a sure shot turns out to be a dud. From our perspective, it is a great partnership, and it makes sense from the long-range studio perspective or they wouldn't be expanding the program."
>
> —*Bruce Berman, Chairman/CEO of Village Roadshow (a frequent cofinancing partner with Warners) as quoted in Variety on February 4, 2000.*

The above quote summarizes the common view in the movie industry—making movies is risky, cofinancing is a risk management tool, and studios seek to cofinance movies that appear less likely to be blockbusters. In this study, we analyze the data to try to verify these claims. This section focuses on the more literal interpretation of the above quote: do studios choose to cofinance relatively risky movies? In the next section, we consider a slightly different interpretation: do studios choose to cofinance movies based on the riskiness of their overall portfolio of movies?

We examine the empirical distributions of ROI for cofinanced movies and for solo-owned movies. If studios choose to cofinance the relatively risky movies, then the distribution of realized ROI for cofinanced movies should almost certainly differ from the distribution for solo-owned movies.[22] This is an appealing test of whether studios choose to cofinance relatively risky films for two reasons. First, we make no assumptions about the information that is used by studios in deciding which films to cofinance. In particular, studios may rely on private information that we do not observe. Second, we make no assumptions about the relevant metric of risk. It could be that risk is defined as the variance of the distribution of ROI, or the probability that a film loses money, or any other measure that is a function of the distribution of ROI. We simply look for differences in the empirical distributions of ROI for cofinanced versus solo-owned movies.[23]

[22] We may also expect the distributions to differ in particular ways, but since we show these distributions are identical, such conjectures are moot.

[23] Note, the approach also requires no assumptions about what fraction of ownership a studio takes in any given cofinanced movie. It makes no difference whether the ownership is a 50-50 split or any other division. The only assumption is that both costs and revenues are split in the same ratio.

We show the non-parametric distributions of ex-post ROI for cofinanced and solo-owned films in Figure 4. We present three conditional distributions of $log(ROI)$:[24] (i) all movies, (ii) movies cofinanced by a major studio (with either an independent or other major studio), and (iii) movies solo-owned by studios. The distribution of returns for movies involving a major studio stochastically dominates the distribution for all movies. This suggests studios are able to select more profitable movie projects, or that studios are more capable at making profitable movies than the independents. Whatever the explanation for the difference in returns between independently-produced and studio-produced films, the difference appears to be dramatic. In contrast, no such difference in returns exists between studios' solo-owned movies and studios' cofinanced movies. Hence, whatever determines which movies the studios choose to cofinance and which movies to solo-own, it does not appear to be based on differences in the distributions of returns.

Applying formal statistical tests, we find both the mean and variance of the distributions of ROI for cofinanced films and solo-owned films are not significantly different to each other at the .05 significance level. With only 32 films cofinanced by two major studios, it is meaningless to plot the non-parametric distribution of ROI for these films alone. However, we find the mean and variance of the distribution of ROI for multi-studio cofinanced films are not significantly different to the mean and variance of either solo-owned films, or of films that are cofinanced with an independent. Furthermore, at the .05 significance level we fail to reject a Kolmogorov-Smirnov test of the hypothesis that the two distributions are identical.

As a robustness test of our revenue measure (US box office revenue), we also test for differences in the conditional means and variances of ROI using the smaller samples of movies for which we observe foreign box office and/or video revenue. We consider three subsamples. First, there are 168 films for which we observe revenues from the US box office, foreign box office and video market. Of these films, 48 are cofinanced by a major with an independent, and 4 are cofinanced by two major studios. Second, there are 714 films for which we observe video revenue, of which 180 are cofinanced with an independent and 8 are cofinanced by two majors. Third, there are 504 films for which we observe foreign box office, of which 159 are cofinanced with an independent and 25 are cofinanced by two major studios. In all three cases, we fail to reject the hypotheses that either the mean or variance of the distribution of ROI is statistically different according to whether the films are cofinanced or solo-owned.

It may not be surprising that the mean of the distribution of ROI for cofinanced movies

[24] We use $log(ROI)$ instead of ROI for clarity of the figure, since ROI is highly skewed.

is the same as for studios' solo-owned movies. It is conceivable that cofinancing partners are only willing to participate if they know they are not merely offered the low return movies.[25] The claim, however, is that studios tend to cofinance relatively risky films, not necessarily films that tend to make higher or lower returns. Economists typically think of variance as a relevant measure of risk, yet we find no evidence that studios cofinance films with higher variance of ROI. Moreover, given that the entire distributions are the same, any risk measure based on any feature of the ROI distribution, would be the same for solo-owned and cofinanced films.

The main concern with the above analysis is reverse-causality—cofinancing choices may affect the ROI of a movie. Cofinancing may conceivably impact ROI in various ways. For example, given the choice between two movies to release on a weekend with a high level of demand (such as Memorial Day weekend), the studio's profits would be higher from choosing a solo-owned movie over a cofinanced movie, all else equal. In this case, we expect the studio's post-contractual behavior increases the mean of the distribution of ROI for solo-owned movies, and may also reduce the variance. If studios choose to solo-own relatively less risky films, this kind of post-contractual behavior would serve to exacerbate the differences in the distributions of ROI for cofinanced and solo-owned movies. In other words, this is all the more reason to expect the distributions to differ.

Alternatively, the cofinancing partner may provide resources or expertise that lowers the risk of the movie.[26] This effect would tend to make the distributions of ex-post returns for solo-owned and cofinanced films more similar to each other. Although it would be fairly remarkable if this effect led to the outcome that these two distributions were identical to each other, as we find. Also, we are unaware of any anecdotal evidence suggesting that cofinancing causes a decrease in the risk of a film.

The densities in Figure 4 are constructed from the pooled set of films for all studios and may be misleading if there is significant heterogeneity across studios. For example, some studios may be more effective at determining which movies to cofinance, or there may be heterogeneity in studios' abilities to obtain cofinancing partners for risky pictures. There are too few observations for each studio to construct useful non-parametric densities for each studio for each type of financing. Instead, in Table 4 we present summary statistics for the distributions of ROI for each studio, conditional on the type of financing. As with the robustness check concerning the measure of revenue, we can also test for differences in the mean and variance of ROI for

[25] At the time of agreeing to cofinance a movie, an independent can read the script, view any initial filming that has been done, and knows as much about the talent involved on the picture as the studio.

[26] We are grateful to an anonymous referee for pointing this out.

cofinanced versus solo-owned movies, separately for each studio. In Table 4 we use an asterisk to identify instances where the mean or variance of ROI for cofinanced movies is statistically different (with 95% confidence) from the counterpart for solo-owned films for that studio. There are several instances where statistically significant differences arise. Films that are cofinanced with an independent by Paramount and Universal have lower mean and variance in ROI than their respective solo-owned movies. Recall that the claim is that cofinanced movies tend to be more risky, which is the opposite to this result. Indeed, there is not one example in Table 4 where cofinanced movies have statistically significant higher variance in ROI than the solo-owned movies. There are few other statistically significant differences in this table. Hence, we do not detect significant heterogeneity across studios.

The high variances in ROI, as reported in Table 4, suggest that cofinancing choices can potentially have a big impact on studios' profitability. Depending on which movies are cofinanced, the overall portfolio ROI can vary substantially. As an illustration, we compute the ex-post best-case and worst-case scenarios for portfolio ROI based on counterfactual choices of which films are cofinanced. To do so, we make the following assumptions: (i) there is no change in the set of films that are made by each studio, (ii) cofinancing is always a 50-50 split of costs and revenues, and (iii) each film's ROI does not depend on whether it is cofinanced (i.e., no reverse-causality).[27] For example, the actual overall ROI for Paramount is 1.68. However, if Paramount had cofinanced their poor performers and solo-owned their best movies, the ROI would have been 2.02. Similarly, the worst case scenario would have resulted in an ROI of 1.30. Also, had Paramount not cofinanced a single movie (still making the same movies), the ROI would have been 1.62. In this case, Paramount earned a slightly higher ROI as a result of its cofinancing decisions, compared to solo-ownership of the same films. This finding holds for all studios—the difference in overall ROI between the observed cofinancing and the counterfactual of solo-ownership of the same films, is small, yet the best-case and worst-case differences indicate substantial opportunity to improve or worsen portfolio ROI.

[27] Under these assumptions cofinancing all movies is equivalent to solo-ownership of all movies, in terms of portfolio ROI.

4 Cofinancing to Manage Portfolio Risk

In the preceding section we showed that movies cofinanced by studios are no different to their solo-owned movies, from the point of view of realized returns. Hence, the benefit of cofinancing is not driven by the studios' abilities to selectively cofinance riskier films. In this section we examine the possibility that cofinancing decisions are based on the riskiness of the overall portfolio of films being made by each studio. There are two subsections. In the first subsection we consider the possibility that a particular movie being cofinanced may depend on the portfolio of movies the studio is scheduled to release near in time to the movie under consideration. To be more specific, a studio may cofinance a movie if the return on the film is positively correlated, say, with the return for the portfolio of movies the studio is releasing in the months before and after this movie. In other words, cofinancing decisions may depend on covariances in returns between movies. In the second subsection we examine the potential for cofinancing to reduce risk via the law of large numbers, since it allows studios to invest in more films for a given total budget.

4.1 Covariances in Movie Returns

Portfolio choice theory emphasizes the role that covariances in the returns of individual risky assets play in determining the riskiness of the portfolio. In contrast to traded stocks, we observe revenue for a movie only once, preventing us from directly calculating the covariance in revenues for two specific movies.[28] Instead, we define movie types for which we observe multiple revenue outcomes over time, allowing us to estimate the covariance in revenues between types of movies. Non-zero covariances in revenue between movies of different types may arise if demand for one type of movie tends to be high at the same time that demand for another type of movie tends to be low. This reasoning suggests the need to define movie types that are relevant to the demand for movies. For example, ratings are unlikely to be an important source of covariances in revenues, since it is unlikely that high demand for PG movies would imply low demand for R movies in the same period. On the other hand, it seems plausible that tastes for one genre may be negatively correlated with tastes for another genre. We therefore categorize movies according to the primary genre (as specified by ACNielsen-EDI): action, adventure, animation, comedy, documentary, drama, fantasy, horror, musical, romance, sci-fi, thriller, and western. While other type-definitions are possible, we believe this is a sensible approach.

[28] Assuming the production cost is non-stochastic, we analyze covariances in ROI by estimating covariances in revenues. In Section 2 we discussed why it is reasonable to assume non-stochastic cost.

To estimate the covariance in revenues of movies types, we use a specification in which an observation is a pair of individual movies. For movie i we denote u_i as the unpredicted component of revenue, r_i. In particular $u_i = r_i - E(r_i)$, where $E(r_i)$ conditions on the same observables reported in Table 3. Let G denote the number of different movie types (or genres). The dummy variable D_i^m equals one if movie i is of type m and zero otherwise. For any pair of movies i and j, $I(|t_i - t_j| \leq T)$ is an indicator function that identifies if these two movies were released within a certain time frame of each other (T). The covariance in the unpredicted components of the revenues for movies i and j is assumed to be given by

$$E(u_i u_j) = I(|t_i - t_j| \leq T) \sum_{m=1}^{G} \sum_{n=m}^{G} \gamma_{mn} D_i^m D_j^n.$$

We estimate the γ's by performing OLS on the following equation:

$$\hat{u}_i \hat{u}_j = I(|t_i - t_j| \leq T) \sum_{m=1}^{G} \sum_{n=m}^{G} \gamma_{mn} D_i^m D_j^n + \epsilon_{ij},$$

where T is pre-specified.[29]

In unreported results, we find the estimated γ's are all insignificantly different from zero. While studios may have better information about their own films than we do, it is less likely they have better information about the films by other studios. Therefore, studios are probably no better able to identify covariances than we are. As such, a portfolio of films that spans genre characteristics is not a diversified portfolio in the sense of reducing variance of portfolio returns. This implies studios are unable to choose diversified movie portfolios. While studios may desire to make different types of films to reduce competition with their own pictures and to serve consumers' varying tastes, this is to maximize expected returns rather than to reduce the variance of portfolio returns.

4.2 Cofinancing and the Law of Large Numbers

We have shown that the distribution of ex-post ROI is the same for cofinanced studio movies as for solo-owned studio movies, and that covariances in returns between movies of different types are insignificantly different from zero. We conclude from this that, contrary to anecdotal evidence, studios do not appear to cofinance relatively riskier movies, and cofinancing decisions are likely to be independent across movies (since covariances are zero).

[29] We try various values for T ranging from 30 to 180 days.

There is, however, still the possibility that cofinancing serves to reduce risk simply by the law of large numbers. Suppose the ROI for studio produced movies are independent draws from an identical distribution. Then the variance of ROI for a portfolio of movies is decreasing in the number of movies in the portfolio. More formally, let σ^2 denote the variance of the distribution of individual movie ROI. Suppose a given studio has N films in their portfolio, indexed $i = 1, ..., N$. Let s_i be the cost share of the total budget for movie i, such that $\sum_{i=1}^{N} s_i = 1$. The variance of the portfolio ROI is then equal to $\sigma^2 \sum_{i=1}^{N} s_i^2$. Hence, making two equal cost movies yields a lower variance portfolio than making one movie at the same total cost.

Consider a studio with a total budget of $100 million. Under the above assumptions, the ROI of their portfolio is the same whether they solo own ten movies each costing $10 million, or have 50% ownership in ten movies each costing $20 million. Hence, cofinancing is unnecessary to achieve a low risk portfolio. Suppose instead that big budget movies tend to have a higher ROI. In this case, studios would like to make big budget movies, but doing so exhausts much of the total budget and may lead to increased portfolio risk, since they forgo the ability of making many movies. Cofinancing could provide a solution, since it would allow a studio to obtain the higher expected ROI associated with big budget movies, for only half the cost. In the extreme, a studio would take a small share in a large number of big budget movies.

The question therefore arises as to whether ROI is in fact higher for big budget movies? In Figure 5 we depict ROI for studio-made movies (cofinanced and solo-owned) as a non-parametric function of budget. The function is constructed using a uniform kernel, which is why there are occasional discrete jumps.[30] The figure shows the mean with 90% confidence intervals, and the 10th and 90th percentiles. Mean ROI is fairly constant for budgets in the range of $20 million to $120 million. Moreover, the confidence bands for the mean indicate we fail to reject the hypothesis of a constant mean in this region. For movies with budgets over $120 million, mean ROI is increasing, but the confidence interval for the mean is large because of the relatively few movies with budgets in this range and their high dispersion in outcomes for these movies (as evidenced by the widening of the 10th and 90th percentiles).

Figure 5 also reveals that expected ROI for films with budgets less than $10 million is significantly higher than for films with budgets exceeding $20 million. This suggests that studios ought to make many low budget films. Although if studios are averse to the variance of ROI, the 10^{th} and 90^{th} percentiles are wider for low budget films than other films, providing a disincentive to make low budget movies. Figure 6 speaks more directly to this issue by plotting the (non-

[30]The function changes very little when we use a variety of bandwidths from $5 million to $20 million.

parametric) standard deviation of ROI, along with its 90% bootstrapped confidence interval. This measure of risk indeed falls significantly over the budget range from zero to $80 million.[31] Hence, individual low budget movies appear to be higher risk with higher expected returns. From a portfolio perspective, however, such films are still attractive since a portfolio of, say, eighty $1 million films has a much lower variance and higher expected return than a single $80 million film.

Our analysis of risk reduction by the law of large numbers leads us to the following conclusion. Assuming that (i) studios face no constraints on the availability of potential movies at any budget level, (ii) studios have fixed total annual budgets, (iii) studios are risk averse, and (iv) the appropriate measure of risk is the variance of portfolio ROI, then solo-ownership of many small budget movies is preferred to cofinancing big-budget movies. How reasonable are these assumptions? There must be some limits on the availability of scripts/ideas for films, however the supply is probably well in excess of current demand levels by studios. In fact, during the period of our data, there are 687 independent movies that are wide-released, compared to 1,305 studio-released movies.[32] This suggests ample supply of low budget movies may be available to the studios. Assumptions two and three seem plausible to us. But the fourth assumption is perhaps the most questionable, since there are various reasonable alternative risk definitions for this industry. We explore this issue in the next section.

5 Alternative Explanations of Cofinancing

The analysis in our study so far suggests that cofinancing is an ineffective tool for managing risk in the movie industry. The main findings are (i) the distributions of ex-post ROI for cofinanced and solo-owned movies are identical, and (ii) big budget movies do not have higher returns than low budget movies. These facts indicate that studios do not selectively cofinance relatively risky movies, nor do they need to participate in big budget films to attain a relatively high portfolio ROI with relatively low variance. It would, however, seem remarkable that studios' cofinancing decisions are unrelated to risk management. Articles in the trade press, conversations with industry-insiders, and our own intuition, all lead to a strong prior belief that studios do indeed use cofinancing as a risk management tool. In the first subsection we propose a possible solution to this puzzle—an alternative explanation that is consistent with our findings thus far, while

[31] Beyond $80 million the standard deviation of ROI increases, although it is measured imprecisely.

[32] The mean budget for the wide-released independent movies is $18.8 million, versus $31.4 million for the studio movies. We define a wide-release to be a movie that opens on at least 400 screens.

also implying a risk-management role for cofinancing. In the second subsection we consider a different motive for cofinancing. Namely, that cofinancing mitigates release-date competition between major studios.

5.1 Cofinancing to Make More Big Budget Movies

Cofinancing may help studios reduce their exposure to risk under the following scenario. If studios have a preference for making big budget movies, for some reason, and have fixed annual total budgets, then cofinancing reduces the riskiness of their overall portfolio, by the law of large numbers. However, for this to be a reasonable explanation of how studios use cofinancing to manage risk, we need to address two issues. First, is it reasonable to assume that studios prefer making big budget movies—why would a studio have a preference for making big budget movies? Second, we have shown above that production budget is uncorrelated with studios' cofinancing decisions with independents (which is the overwhelming majority of cofinancing).[33] If the point of cofinancing is to increase the number of movies a studio can invest in, then this is puzzling. Studios should be more likely to cofinance big budget movies, since this will free-up the most funds for investment in other films. In this subsection, we address both of these concerns.

Why might studios have a preference for making big budget movies? We offer no empirical support for an answer to this question. However, the following two explanations seem plausible. One reason may be the presence of an agency problem. Studio executives who decide which movies to make may have a bias toward films with stars. This could be because an executive's career is harmed if they greenlight a single picture with unproven talent which then flops at the box office, even if this executive's track-record is otherwise solid. Given the perception that "nobody ever gets fired for making a movie with Julia Roberts or Tom Cruise," studio managers may prefer to make movies with stars, which also tend to have higher budgets.

A second possible reason is to produce so-called "event movies", that spawn theme park rides and merchandising opportunities. An example is the movie *Spiderman*, produced by Universal in 2002. At Universal's theme park in Orlando, Florida, the *The Amazing Adventures of Spiderman* ride was also opened. Invariably, such event movies also have big budgets, since they involve a high degree of special effects, making them appealing for theme park rides and merchandising.[34]

[33] Budget is uncorrelated with cofinancing with independents regardless of whether we condition on observable characteristics or not.

[34] Another possible reason, suggested by a referee, is that big budget movies may be easier to advertise than small budget movies.

As noted above, if the purpose of cofinancing is to reduce portfolio risk by increasing the number of movies a studio invests in, then we expect big budget movies are more likely to be cofinanced. Indeed this is the case for relatively few films that are cofinanced with two major studios. However, Table 3 shows that budget is conditionally uncorrelated with the probability that a film is cofinanced by a major studio with an independent. However, it may not be the absolute budget that is most relevant, rather the fraction of a studios total annual budget. For example, it may be less relevant that a movie costs $100 million, than it is that the movie accounts for a significant share of the studio's total annual production budget.

To explore this possibility, we estimate a linear probability model in which the dependent variable is a dummy for whether a film is cofinanced. We use the 1,305 studio-made movies that we used in previous specifications. On the right-hand side are three variables: a constant, cost and cost divided by total annual cost of that studio's other movies.[35] The coefficient on cost is insignificantly different from zero (t-statistic of 0.5). However, the coefficient on cost share of total budget is positive and significant (t-statistic of 2.3). These findings are robust to the inclusion of additional variables: cost-squared, genre dummies, year dummies, studio dummies, and number of stars. Indeed, the more controls we include, the larger and more significant is the coefficient on the cost share of total budget. Note that, when we include studio dummies to control for time-invariant differences across studios, the coefficient on cost share is identified by within-studio variation. Hence, the results are not driven by cross-studio heterogeneity.

The evidence indicates that cofinancing decisions depend on a movie's cost as a fraction of the total annual production budget, rather than absolute cost of the individual movie. This makes sense. Recall from the previous section that the variance of portfolio ROI is $\sigma^2 \sum_{i=1}^{N} s_i^2$, assuming the ROI for each movie is an independent draw from an identical distribution with variance σ^2. Since portfolio variance depends on the sum of squared cost shares, it will be minimized when all movies have equal shares (for a given number of films, N). That is to say, there are two effects to consider in risk reduction via the law of large numbers. First, investing in more movies will lower the variance of portfolio ROI. Second, given a choice of which film to cofinance from a given set, the variance of portfolio ROI will be lowered the most by choosing the movie with the largest share of total cost.

In fact, assuming the cost of negotiating a cofinancing contract is constant across movies,

[35] To compute the total annual budget we sum the equity contributions to films that are released by the studio in the same year, assuming cofinancing partners equally divide production budgets. For the 32 cofinanced films involving two majors, we use the smaller of the two total costs.

one can derive a threshold budget above which any film would be cofinanced.[36] To assess the degree to which such a model explains actual cofinancing decisions, we inspect the ability of cost share to predict cofinancing. The linear probability model that conditions only on cost share yields a coefficient of 0.30 and an R-squared of 0.0072.[37] Hence, while the coefficient on cost share is large and statistically significant, cofinancing decisions appear to be driven primarily by other considerations.

5.2 Impact of Cofinancing on Release Dates

> "In a business where we're always trying to get the advantage, it's not so bad to sit in a screening knowing that there are people from other studios who are also invested in the picture."
>
> —*Joe Roth, Chairman of Disney, as quoted in Variety on July 28, 1997.*

In the previous subsection we argued that cofinancing may be an effective risk management, under the assumption that studios have a preference for making big budget movies. In this subsection we offer a second alternative explanation for cofinancing, that is specific to cofinancing between two major studios—we present evidence that cofinancing with multiple major studios leads to softer competition with respect to release dates.[38] This would be consistent with the above quote by Joe Roth and suggests one possible motive for cofinancing with other major studios.

To mitigate competition among their own movies, each studio spreads out the release dates of their films. Similarly, two studios engaged in cofinancing may spread out the release dates of their solo-owned movies from the date for the cofinanced film. Indeed it would be surprising if this were not the case, since it is optimal for the cofinancing partners to internalize the effects of all their release date choices on all movies in which they have an ownership stake. The point is, however, that cofinancing leads to softer release date competition between cofinancing partners than when the studios do not cofinance with each other.

[36] The threshold budget would depend on the studio's risk tolerance. That is, the portfolio's mean return would be lowered by the contracting costs in exchange for lowering its variance. At the optimal threshold, the marginal benefit of the lower variance would equal the marginal (contracting) cost of cofinancing.

[37] The R-squared increases to 0.0074 and the coefficient on cost share decreases to 0.26 when we also condition on budget.

[38] Chisholm (2000), Corts (2001) and Einav (2003a and 2003b) all argue that movie release dates are a particularly important aspect of competition.

We define the variable $DAYS_{is}$, as the number of days between the release date of movie i and the nearest release date of a movie produced by studio s. For solo-owned films, we omit the observation corresponding to the nearest release date for a movie by the same studio.[39] However, for cofinanced films we include the number of days between releases of these cofinancing partners. Our hypothesis is that the number of days between release dates of films by studio pairs is lower when the studios are cofinancing partners. To test this hypothesis, we construct a dummy variable CF_{is} which equals one if s is a cofinancing partner for movie i. If cofinancing tends to soften release date competition between cofinancing partners, then we should find that CF has a positive effect on $DAYS$.

A spurious positive correlation between $DAYS$ and CF may arise if (i) cofinancing is relatively more common in periods when fewer movies tend to be released (either year-to-year variation or seasonal variation), or (ii) cofinancing partners tend to release fewer movies than the other studios. In both cases cofinancing would be correlated with fewer movies being released, and therefore more days between releases. To address this issue we construct the variable AD_{is}, which is the average number of days between (consecutive) releases by studio s, over the period three months before and after the release date of film i.[40]

We estimate the following specification:

$$DAYS_{is} = \alpha + \beta CF_{is} + \gamma AD_{is} + \epsilon_{is},$$

where ϵ is a residual and α, β, and γ are coefficients to be estimated. In Table 5 we first report the results when the variable AD is excluded. As shown in the table, the coefficient (and standard error) on CF is almost identical when we include AD, revealing that none of the above mentioned spurious correlations are present in the data. The main difference between the two specifications is the overall explanatory power. The estimate for β is 5.5 and is statistically different from zero at the 1% significance level.

The estimates for the above specification support the view that studios engage in cofinancing with another major studio in order to coordinate release dates. But it is important to note that this simple specification could be enhanced in various ways, which would be warranted for a thorough investigation of this alternative explanation. For example, it is reasonable to expect that the benefits of coordinating release dates are greatest for movies that compete for the same

[39] Hence, for each solo-owned movie we construct seven observations—one for each of the number of days to the nearest release by each of the other seven studios (there are eight major studios).

[40] Our results are robust to setting the length of this window to a range of values.

consumers.[41]

6 Conclusion

The high degree of risk facing firms in the motion picture industry makes it plausible that these firms would seek to mitigate their exposure to risk. To this end, cofinancing seems like it should be an effective risk management tool—studios can reduce their exposure to films that appear more risky and can invest in a larger number of big budget movies. Moreover, this view of cofinancing is pervasive in the trade press and has been clearly expressed to us by industry-insiders.

In this study we show that around one-third of the movies produced by the major studios between 1987 and 2000 were cofinanced. Hence, cofinancing appears to be an important aspect of firm behavior in the industry. Comparing the empirical distribution of ROI for studios' cofinanced movies to their solo-owned movies, we find the two distributions are identical to each other. Based on this, we conclude that studios do not cofinance relatively risky movies, despite the anecdotal evidence.

Nevertheless, cofinancing still provides a risk-management benefit, by reducing the riskiness of portfolio ROI, due to the law of large numbers. To this end, we show that studios are more likely to cofinance movies that account for a large fraction of their annual production cost budget. This makes sense, since the variance of portfolio ROI is minimized when all movies have equal cost shares. In other words, we find no evidence that studios selectively cofinance films that are relatively high risk. However, we do find evidence that studios cofinance movies that tend to lower the riskiness of their overall portfolios.

We also propose an alternative explanation for cofinancing, in the case of multi-studio partnerships. We show that cofinancing partners tend to release their movies further apart from each other when they cofinance a movie together. A possible interpretation is that studios are more likely to seek softer release competition from competitors (by cofinancing with them) for movies with a large budget at stake.

[41] One possibility would be allowing β to vary according to whether the two films are of the same genre and/or ratings.

Bibliography

Chisholm, D.C. (2000): "The War of Attrition and Optimal Timing of Motion-Picture Releases," *Mimeo*, Lehigh University.

Cones, J.W. (1998): *43 Ways to Finance Your Feature Film" A Comprehensive Analysis of Film Finance*, Southern Illinois University Press.

Corts, K.S. (2001): "The Strategic Effects of Vertical Market Structure: Common Agency and Divisionalization in the US Motion Picture Industry," *Journal of Economics and Management Strategy*, 10(4), 509–28.

De Vany, A. and W.D. Walls (1996): "Bose-Einstein Dynamics and Adaptive Contracting in the Motion Picture Industry," *Economic Journal*, 106, 1493–514.

De Vany, A. and W.D. Walls (1997): "The Market for Motion Pictures: Rank, Revenue and Survival," *Economic Inquiry*, 35, 783–97.

De Vany, A. and W.D. Walls (1999): "Uncertainty in the Movie Industry: Does Star Power Reduce the Terror of the Box Office?" *Journal of Cultural Economics*.

De Vany, A. and W.D. Walls (2002): "Does Hollywood Make Too Many R-rated Movies? Risk, Stochastic Dominance, and the Illusion of Expectation," *Journal of Business*, 75(3), 425–51.

Desai, M.A., G.J. Loeb and M.F. Veblen (2002): "The Strategy and Sources of Motion Picture Finance," *Harvard Business School Teaching Case*, No. 9-2-3-007.

Eliashberg, J. and S.M. Shugan (1997): "Film Critics: Influencers or Predictors?" *Journal of Marketing*, 61, 68–78.

Einav, L. (2003a): "Gross Seasonality and Underlying Seasonality: Evidence from the US Motion Picture Industry," *Mimeo*, Stanford University.

Einav, L. (2003b): "Not All Rivals Look Alike: Estimating an Equilibrium Model of The Release Date Timing Game," *Mimeo*, Stanford University.

Fee, C. E. (2002): "The Costs of Outside Equity Control: Evidence from Motion Picture Financing Decisions," *Journal of Business*, 75, 681–711.

Lambert, R.A. (1986): "Executive Effort and Selection of Risky Projects," *RAND Journal of Economics*, 17(1), 77–88.

Moul, C. (2003a): "No Choice to Chaos? An Alternative for Industries Facing State-dependence in Demand," *Mimeo*, Washington University.

Moul, C. (2003b): "Title-Specific Saturation and the Demand for Motion Pictures," *Mimeo*, Washington University.

Neelamegha, R. and P. Chintagunta (1999): "A Bayesian Model to Forecast New Product Performance in Domestic and International Markets," *Marketing Science*, 18, 115–136.

Ravid, S.A. (1999): "Information, Blockbusters, and Stars: A Study of the Film Industry," *Journal of Business*, 72(4), 463–92.

Ravid, S.A. and S. Basuroy (2004): "Beyond Morality and Ethics—Executive Objective Function, the R-rating Puzzle and the Production of Violent Movies," *Journal of Business*, 77(2), 155–92.

Sawhney, M.S. and J. Eliashberg (1996): "A Parsimonious Model for Forecasting Gross Box Office Revenues of Motion Pictures," *Marketing Science*, 15, 113–131.

Table 1: Summary Statistics of the Data

	mean	median	min	max	std
North-American Box office	20.14	4.82	0.01	589.31	37.88
Budget	20.77	14.41	0.02	196.18	21.12
No. Screens	870.46	525.00	25.00	3669.00	899.09
No. Stars	1.79	1.00	1.00	10.00	1.07
No. Equity Firms	1.40	1.00	1.00	5.00	0.68
No. Big 8 Equity Firms	1.02	1.00	1.00	2.00	0.15
Adventure	0.0214				
Animation	0.0240				
Comedy	0.2525				
Documentary	0.0379				
Drama	0.0852				
Fantasy	0.0123				
Horror	0.0491				
Musical	0.0110				
Romance	0.0685				
Sci-Fi	0.0201				
Thriller	0.0727				
Western	0.0058				
G	0.0340				
PG	0.1579				
PG13	0.2224				
R	0.5408				

Table 2: Mean Characteristics of Joint Versus Solo Films

	Sole major studio	Studio plus independent	Multiple major studios
Revenue (1996 $-millions)	42.00	45.31	96.62
Budget (1996 $-millions)	30.54	33.54	62.13
mean(ROI)	1.56	1.47	1.48
median(ROI)	1.03	0.97	1.28
Number of Stars	1.26	1.57	1.66
Action	0.12	0.12	0.19
Adventure	0.03	0.04	0.03
Animation	0.04	0.03	0.06
Comedy	0.32	0.24	0.12
Documentary	0.00	0.00	0.00
Fantasy	0.02	0.02	0.03
Horror	0.05	0.03	0.06
Musical	0.01	0.02	0.00
Romance	0.08	0.07	0.06
Sci-Fi	0.03	0.03	0.03
Thriller	0.07	0.09	0.09
Western	0.00	0.02	0.00
G	0.03	0.04	0.00
PG	0.24	0.18	0.09
PG13	0.31	0.28	0.38
R	0.42	0.49	0.53
Number of Observations	912	361	32

Table 3: Probits for Whether Cofinanced

	Major+Indep. CF		Two Majors CF		Any Combination CF	
	Est. Coef.	t-stat	Est. Coef.	t-stat	Est. Coef.	t-stat
constant	-0.6846	-0.7589	-13.8421	-5.7291	-2.0914	-2.3410
Action	-0.1377	-1.0407	-0.1796	-0.7109	-0.1630	-1.2523
Adventure	0.1067	0.4463	0.1154	0.2134	0.1753	0.7437
Animation	-0.6996	-2.1898	0.0043	0.0120	-0.4790	-1.6353
Comedy	-0.1871	-1.7790	-0.2166	-0.8346	-0.2114	-2.0316
Documenta	0.0554	0.0726	--	--	0.1357	0.1795
Fantasy	0.0973	0.3268	0.3956	0.7396	0.1667	0.5723
Horror	-0.5350	-2.4618	0.3646	1.0050	-0.4643	-2.2261
Musical	0.3312	1.0398	--	--	0.2878	0.9049
Romance	-0.1531	-0.9844	0.0536	0.1525	-0.1599	-1.0422
Sci-Fi	-0.0472	-0.2047	-0.4659	-0.9330	-0.1083	-0.4755
Thriller	-0.0587	-0.3862	-0.0616	-0.1948	-0.0760	-0.5058
Western	0.9349	2.4567	--	--	0.8164	2.1558
G	0.4795	1.6618	--	--	0.2233	0.8104
PG	-0.2245	-1.9722	-0.4327	-1.4364	-0.2814	-2.4946
PG13	-0.1685	-1.8012	-0.0199	-0.1065	-0.1695	-1.8419
log(budget)	0.0165	0.3099	0.6924	4.9934	0.1049	1.9910
Observations	1305		1305		1305	
No. Ones	361		32		393	
McFadden R-sq	.02		.13		.02	

Table 4: Conditional Moments of Ex-Post ROI for each Studio

	Type of financing	Number of films	Mean ROI	Std Dev ROI
All Studios	solo	912	1.56	1.83
	+independent	361	1.47	1.74
	+major	32	1.48	1.09
Paramount	solo	118	1.80	1.95
	+independent	34	1.25 *	0.90 *
	+major	16	1.40	1.34 *
Universal	solo	139	1.63	1.48
	+independent	25	1.03 *	0.90 *
	+major	11	1.64	0.78 *
Warners	solo	129	1.54	1.74
	+independent	66	1.21	1.04
	+major	5	2.22	1.86
MGM	solo	71	1.01	1.43
	+independent	22	1.05	1.34
	+major	1	1.41 *	--
Disney	solo	157	1.73	2.10
	+independent	107	1.99	2.28
	+major	10	0.82 *	0.50 *
20th-Fox	solo	118	1.69	2.02
	+independent	24	1.75	2.65
	+major	6	1.85	0.76 *
Columbia	solo	166	1.27	1.74
	+independent	80	1.24	1.45 *
	+major	7	1.05	0.70
DreamWorks	solo	14	1.70	2.25
	+independent	3	1.55	0.71
	+major	8	1.84	1.02

Table 5: Determinants of Number of Days Between Movies by Different Studios

	Est. Coef.	t-stat	Est. Coef.	t-stat
constant	11.8674	82.1515	3.0818	15.6566
CF	5.5433	3.1575	5.5077	3.7023
AD	---	---	0.2608	56.9943
Observations	8,271		8,271	
R-sq	.0012		.2829	

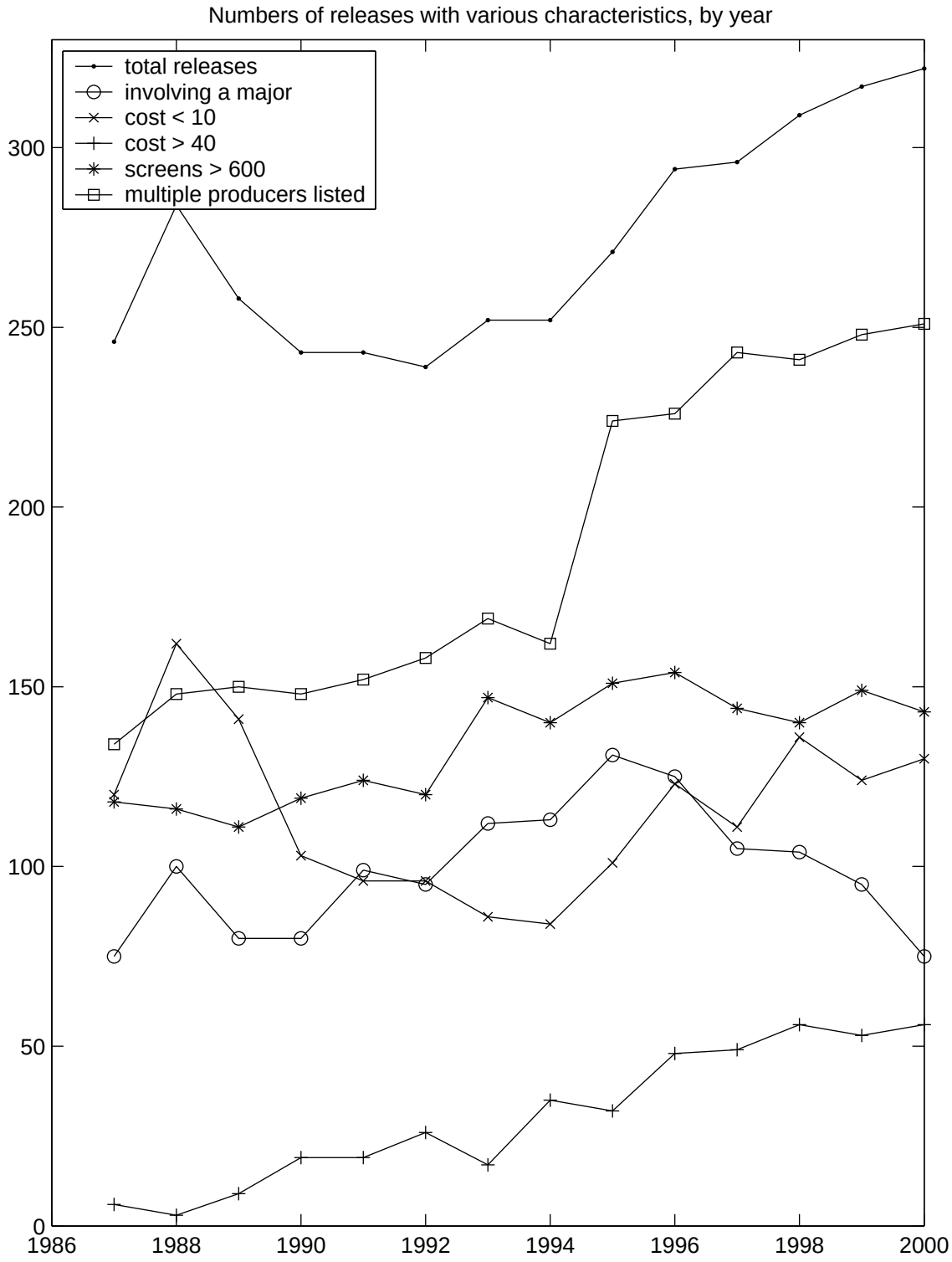
Numbers of releases with various characteristics, by year
total releases
involving a major
cost < 10
cost > 40
screens > 600
multiple producers listed
0
50
100
150
200
250
300
1986
1988
1990
1992
1994
1996
1998
2000

Figure 1.

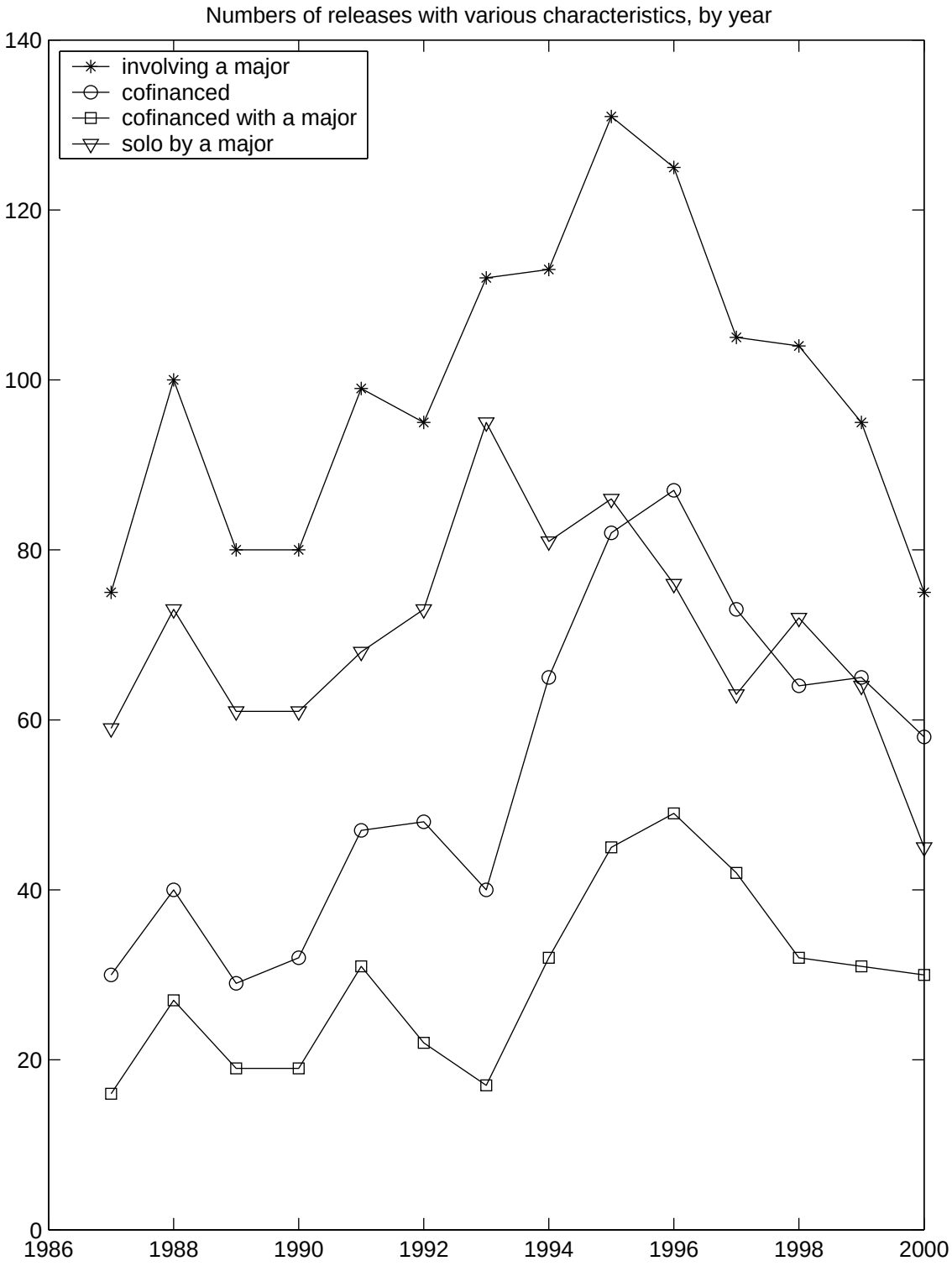
Numbers of releases with various characteristics, by year
involving a major
cofinanced
cofinanced with a major
solo by a major
0
20
40
60
80
100
120
140
1986
1988
1990
1992
1994
1996
1998
2000

Figure 2.

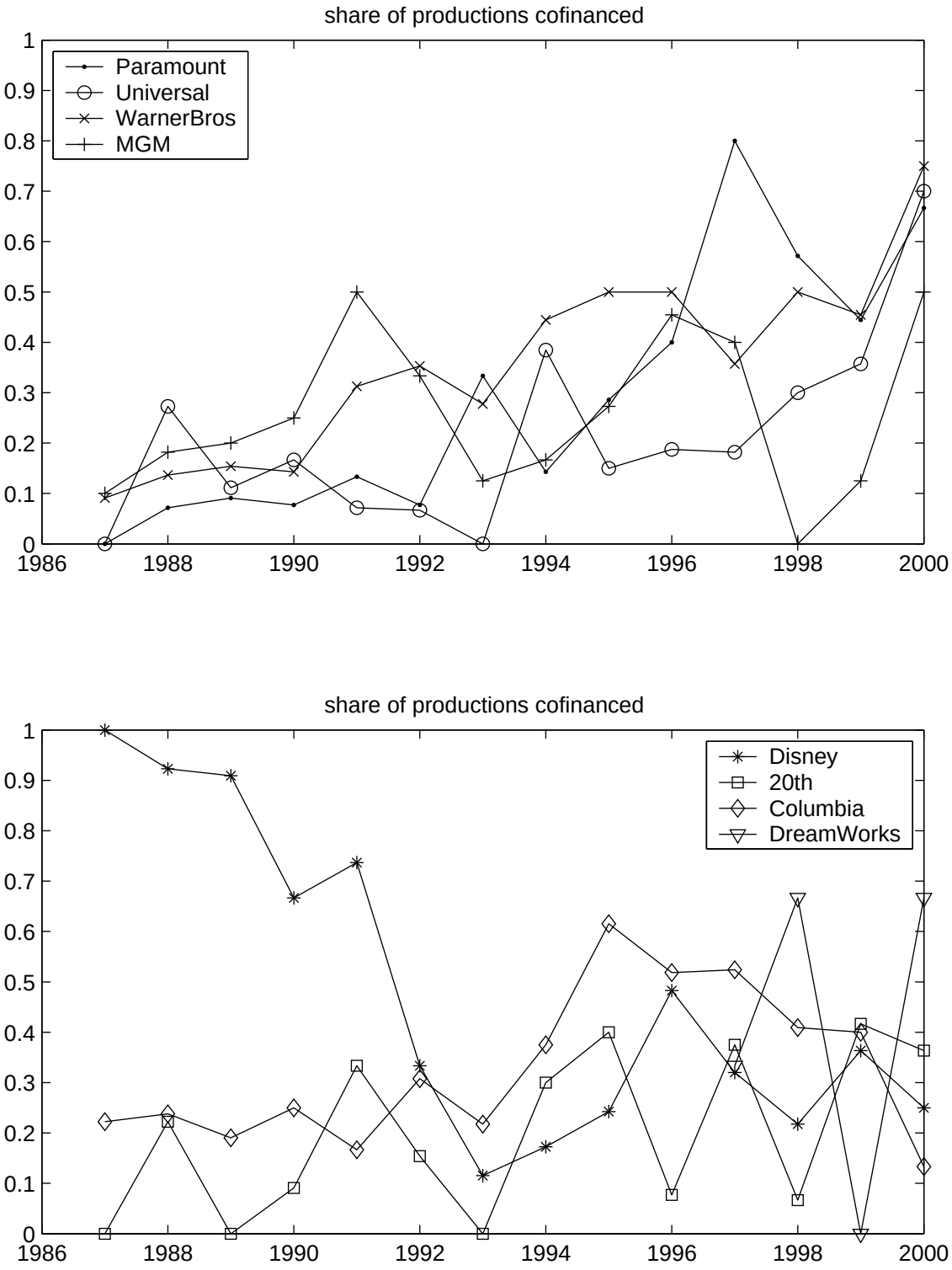
share of productions cofinanced
Paramount
Universal
WarnerBros
MGM
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1986
1988
1990
1992
1994
1996
1998
2000
share of productions cofinanced
Disney
20th
Columbia
DreamWorks
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1986
1988
1990
1992
1994
1996
1998
2000

Figure 3.

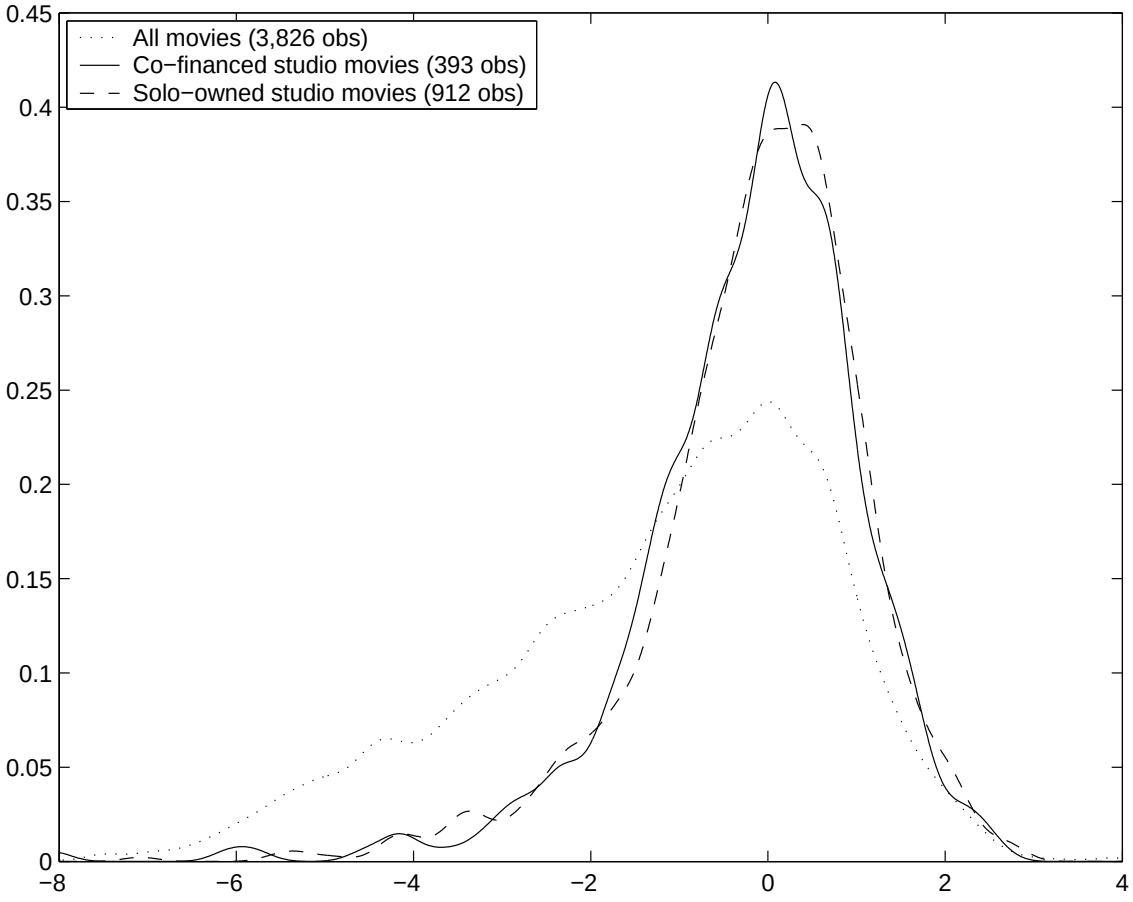

Figure 4. Non-Parametric Conditional Distributions of $log(ROI)$

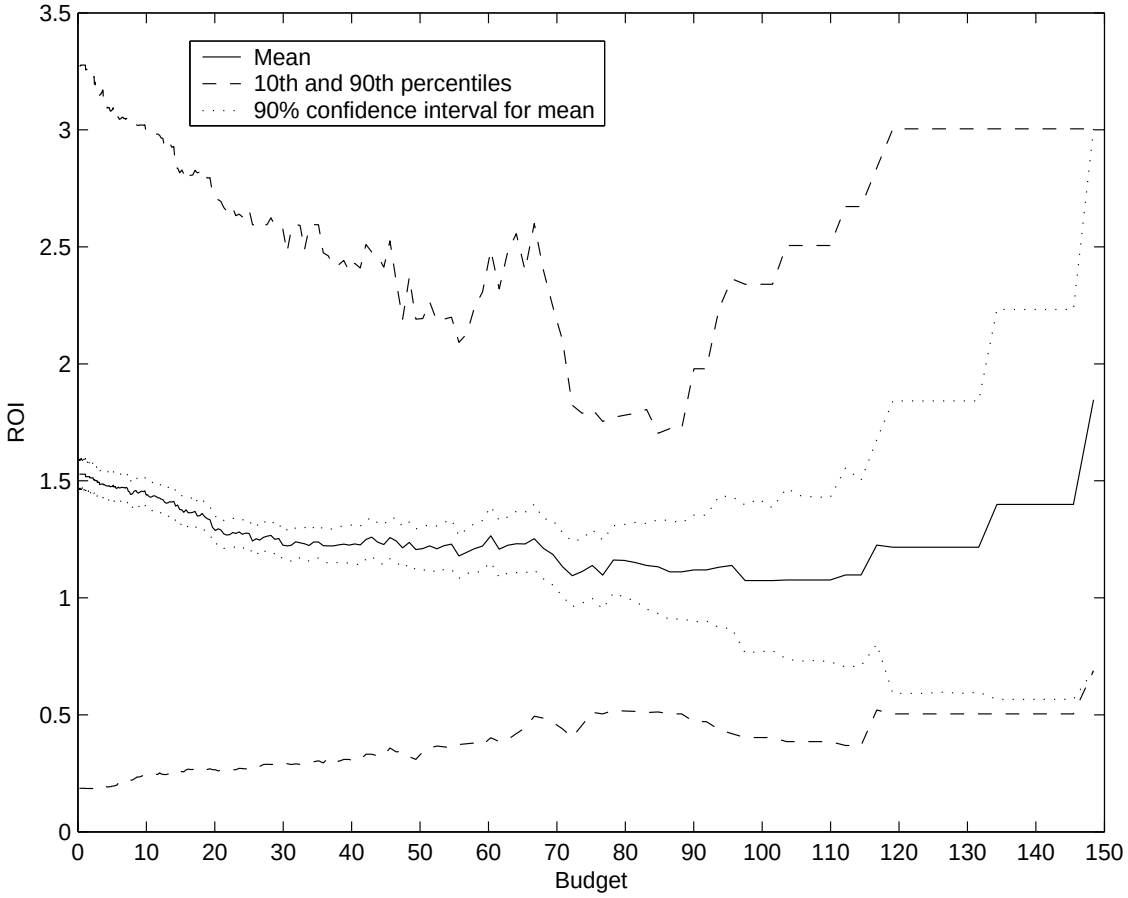

Figure 5. ROI as a Non-Parametric Function of Budget

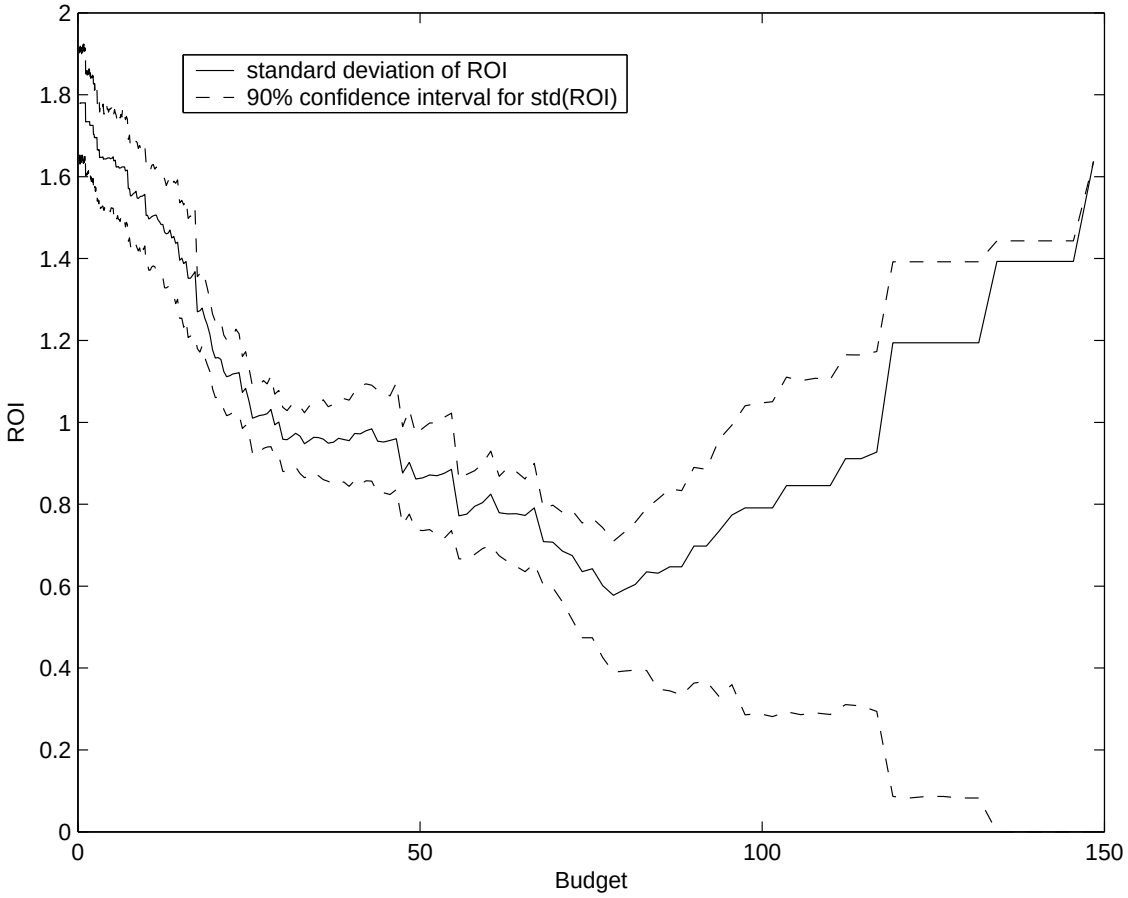

Figure 6. Dispersion in ROI as a Non-Parametric Function of Budget