

Time Consistency and the Distribution of Theatrical Films: An Empirical Study of the Video Window

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Abstract

We report preliminary results of an empirical study of determinants of the video window (the interval between a movie's theatrical release and its video release), primarily based on a sample of 1429 theatrical feature films released on video in the United States between 1988 and 1997. Average video windows have consistently remained in the 180 day range over this period, although there is substantial variation for individual movies. Overall, regression analysis finds that higher VCR penetration has contributed to shorter video windows, that higher box-office performance lengthens windows, and higher production cost movies have shorter windows. We find some evidence that higher interest rates tend to reduce windows, especially for high production cost movies. Independently distributed movies have significantly shorter windows than those of major distributors. The latter result provides preliminary support for our hypothesis that major U.S. distributors (that is, members of the Motion Picture Association of America) resolve a time-consistency problem in setting windows by coordinating their behavior to maintain longer video windows than a fully competitive marketplace would produce. Results suggest that the different behavior of MPAA and non-MPAA distributors in window setting behavior could partly be accounted for by higher capital market pressures that the independents face.

I. Introduction and Background

Media products are often distributed in different forms over a period of time. Prominent examples are books (hardback, then paperback) and movies or other video programs (theaters, then video, pay television, free television, etc.). It is widely claimed that these practices are a form of intertemporal price discrimination, by which "high value" consumers are attracted to relatively high priced hardbacks, theater exhibitions, etc., while "low value" consumers wait to consume the product later on lower priced media (Conant, 1960; Waterman, 1985; Owen and Wildman, 1992).

It is often hard for firms in any industry to maintain a system of intertemporal price discrimination, however, because of the well-known "time consistency" problem (Coase, 1972). Basically, this means that for a seller with monopoly power to effectively price discriminate, that seller must have a way of assuring consumers that there will be some minimum length of time before the price will be reduced. Thus, high value consumers will decide to just wait to pay the lower prices, undermining the price discrimination attempt. Similarly for the next highest value category of consumers, and so on. In the extreme case, the monopolist is unable to make any sales at prices above what would have been the competitive price level.

Considering the movie case, we begin with the assertion that consumers are drawn to theaters on the expectation that there will be some length of time before the film is available on video. These expectations are evidently formed by consumers' perceptions of some *average* video window for movies in the past. Under these circumstances, an individual movie distributor apparently has an incentive to shorten the video window for any particular movie in order to take full advantage of the freshness of the movie and the impact of its theatrical ad campaign. That incentive exists because such an opportunistic decision will have a relatively minor effect on consumers' perceptions of the average video window. In the absence of coordinated behavior by distributors, or of contractual or other commitment mechanisms of some kind, this logic implies that there is a tendency for video windows to collapse over time to a shorter length than the industry would prefer.

In most European countries at least, industry-wide agreements or statutes serve to regulate the minimum video window (Frank, 1994; Paul Kagan Associates, 1994). Table 1

summarizes these mechanisms for 15 European countries as of the mid-1990s, based on trade literature reports, and indicates the window length upon which these agreements or statutes are reportedly based.

In the United States, no legislation governs movie windows, and if any industry agreements prevail, they are not publicly announced. It is notable, however, that before the U.S. Supreme Court outlawed the practice in *U.S. v. Paramount Pictures, et al* (1948), local cartels of theater owners and the major film distributors in major U.S. cities overtly colluded to control a multi-tiered movie release system involving up to 11 sequential runs at progressively lower and lower priced theaters (Conant, 1960). These precursors of the modern multi-media movie release system were found to have facilitated exclusion of independent distributors and independent exhibitors from the market, but we suggest that they may also have had the purpose of maintaining optimal window lengths.

These international and historical comparisons suggest the plausibility of some form of coordinated window setting behavior among U.S. distributors in the modern market. Of course, to the extent that any such behavior serves to exclude other firms from the market, it has anti-competitive effects. In general, though, coordinated behavior leading to successful intertemporal price discrimination in itself would appear to be socially beneficial because effective price discrimination increases the ability of producers to support “first copy” creation costs of products for which there is sufficient total consumer demand (Spence and Owen, 1975). In a general context, Schmalensee (1981), Varian (1985) and others show that price discrimination is welfare-increasing if total output increases as a result. In this context, the main contemporary policy aspect of the video window issue is that although coordination by motion picture studios to maintain longer windows may be socially beneficial, any overt industry collusion to maintain windows would presumably violate U.S. antitrust laws.

In this paper, we employ a statistical sample of 1429 theatrical movies released on video in the United States between 1988 and 1997. We use this sample to conduct a preliminary investigation of the hypothesis that U.S. movie distributors coordinate their behavior to maintain video windows for theatrical films that are longer than would result in a freely competitive market. Our main objective in this paper is to determine whether MPAA member companies behave differently from non-MPAA companies in window

setting, and, more generally, to understand the main economic determinants of window setting behavior by movie distributors. Economic factors that may affect the window are the penetration of other media used for film distribution, namely VCR penetration, the interest rate, and movie-specific factors such as production costs and box-office performance.

II. The Time Consistency Problem

The original insight into the time-consistency problem is due to Coase (1972). Coase's key idea (now commonly known as the "Coase conjecture") was that if firms with monopoly power selling durable goods are unable to commit to maintain prices above costs, then that monopoly power cannot in fact be exercised in the consumer market. Coase also recognized that such firms might employ a variety of devices to avoid the time-consistency problem, such as leasing the product, and thus exercise at least some of their monopoly power. In the leasing case, for example, consumers obviously do not need to worry that the seller will lower the price immediately after purchase. Bulow (1982) formalized the Coase conjecture to establish conditions under which the time-consistency problem would occur and showed how it could be avoided through leasing and other devices. A large theoretical literature extending these results and identifying other strategies or market conditions that can serve as commitment devices has since arisen. For example, firms may establish a reputation for not reducing prices (Bulow, 1982; Tirole, 1988; Ausubel and Denekere, 1989), offer "best price" provisions (Butz, 1990), or somehow destroy or limit future production capacity (Tirole, 1988). Gul (1987) and Ausubel and Denekere (1987) present models of oligopolistic durable good sellers in which the competing firms discipline each other to maintain prices above cost.¹

A parallel literature on the economics of intertemporal price discrimination has explored conditions under which that is a profitable strategy in the first place (Stokey, 1979; Landsberger and Meilijson, 1985, Varian, 1989). It is notable, though, that a number of the commitment devices explored in the time-consistency literature are not conducive to intertemporal price discrimination itself. For example, an artist's public

¹ Among other more relevant contributors to this literature are Stokey (1981), Kahn (1986), Conlisk, et al (1987), Bond and Samuelson (1984, 1987), and Beihl (2001).

destruction of an original work from which prints can be made preserves high prices of existing prints by guaranteeing that no price reductions at all will be made in the future.

Rosen and Rosenfield (1997) apply ideas from the above literature to explain the ticket pricing and other strategies of live theater operators. To our knowledge, no other studies deal with the time-consistency issue in entertainment or information industries in an explicit way. Owen and Wildman (1992) hypothesize a number of factors, such as the interest rate, and the penetration rates of VCRs and other alternative media, that are likely to affect video window lengths, but they offer only a descriptive analysis and do not consider the time-consistency problem.

Frank (1994) has conducted an empirical study of determinants of the movie video window, using German data. He finds that German windows became shorter over time as VCRs diffused, but this research also does not involve the time consistency problem.

Notwithstanding a small number of experimental papers (notably Reynolds, 2000), we are not aware of systematic empirical studies of how firms in any industry make commitments in order to cope with the time consistency problem.

III. Price Discrimination and Time-Consistency in Movie Distribution

In recent years, the eight largest film distributors have controlled about 90% of the U.S. movie box-office, and generally comparable shares of revenue from theatrical feature exhibition on video and pay television systems. (Litman, 1998). Figure 1 illustrates the typical pattern of windows followed by these distributors for a major film in the U.S. The movie begins its life in theaters, a market that is typically exhausted within 1 to 4 months. Except for relatively unimportant airline and hotel pay-per-view showings, the movie is then usually held out of circulation until about the 6th month, when it reappears in stores for rental or sale on prerecorded videocassettes and digital video discs (DVD). Release on DBS pay-per-view channels and on cable PPV networks generally follows 45 to 60 days after home video release. Then about one year after theatrical release, HBO, Showtime, or other monthly subscription premium cable channels claim exclusive exhibition rights for the next 12 or 18 months. The movie then continues on various alternate routes to basic cable networks (eg, on TNT, or TBS)

and/or advertiser-supported broadcast exhibition. Broadcast and cable network syndication contracts usually last for multiple years, and by the time the first complete cycle is ended, a film may be anywhere from six to fifteen years old. More popular movies may also be recycled through this system indefinitely.

Although other motivations are no doubt involved, such as the building of word-of-mouth and the signal of average movie quality that an initial theatrical release conveys, the release system appears to be a price discrimination device. The sequence apparently segments high value from low value consumers by means of the quality of the viewing experience (ie, the wide-screen display in theaters, followed by the smaller TV screen for home video exhibition, followed by the lack of viewer control of scheduling on pay TV channels, and finally a commercial-cluttered showing on broadcast TV), but most fundamentally by the time lags between release to different media. Waterman (1985) and Owen and Wildman (1992) show evidence that per capita realized prices paid by consumers generally decline throughout the sequence, as do per capita distributor gross revenues. Of course, declining prices could simply reflect declining costs of exhibition or a declining value of the movie as it becomes older.² The most compelling suggestion of intertemporal price discrimination is the persistence of periods during which the movie is essentially withdrawn from the market altogether--notably the several weeks or months between the time that most movies complete their theatrical exhibition and their reappearance at video stores. In general, a longer window is more protective of first run theater exhibition, but there are diminishing returns to length because the film becomes older and the impact of the initial theatrical campaign diminishes.

As copyright holders, movie distributors have the exclusive rights to determine the video, as well as other movie windows, in the release sequence. The video window, our focus in this paper, is by far the most important for distributors, since theaters and video respectively account for approximately 25% and 50% of total distributor revenues from U.S. exhibition of theatrical feature films (Paul Kagan Associates, 2001).

² Stokey (1979), Landsberger and Meiljson (1985), and others make this point, but show that intertemporal discrimination can be profitable if sellers have some monopoly power, if there are sufficient numbers of consumers in different demand groups, if consumers are sufficiently different from each other in terms of their demand preferences and their time discount rates, and if enough consumers have higher time discount rates than do producers. See also DeVany and Eckart () for a related alternative theory of the distribution sequence.

In the case of the video window, the distributor's decision problem is simplified in one sense by the First Sale Doctrine of the copyright law, which effectively prevents the distributor from controlling whether videocassettes or DVDs are rented or sold by retailers (Chatterjee, 1985). Thus, release of video rentals and sales occurs on the same date.

Of course, theater admission prices and video rental and sales prices are key elements of the price discrimination system. Distributor control of these prices, however, is only indirect. First, resale price maintenance laws and the First Sale Doctrine prevent distributors from directly controlling them. By manipulating wholesale prices, the distributors can obviously influence retail prices, but both theaters and video retailers generally charge the same prices for all movies regardless of quality, and they maintain those same prices over a period of time. Of course, average industry window lengths will affect equilibrium retail prices at both theaters and video stores, but individual distributors have little power to unilaterally affect retail prices. Our focus, therefore, is on one distributor decision variable: the length of time between a movie's theater and video release.

Coping with the Time Consistency Problem

We pose the video window setting process as a simple competitive game similar to that faced by oligopolists in setting output prices. In our model, consumers are drawn to theaters to see a particular movie based on their expectation of the time lapse before the movie is available on video. Those expectations are in turn assumed to depend on the average window length of all movies in the past.

A numerical model illustrates. Two distributors, A and B, choose video windows, which we assume may be either 2 months or 6 months. For simplicity, distributors A and B are assumed to initially choose the same window length for all of the movies they release. Indicated by the 4,4 payoffs in the NW quadrant, the industry profit-maximizing window is assumed to be 6 months. If both distributors select 6 month windows, consumer expectations are fulfilled at 6 months and both firms maximize profits. However, if distributor A chooses a 2 month video window for its movies and B maintains 6 months, the 5,2 payoffs in the SW quadrant results. In that case, distributor A

sacrifices some revenues because less effective price discrimination results from consumers' new assumption that the average window for all movies will be 4 months (the industry average). The higher overall payoff to A results from the benefit of surprising consumers with releases to video that are earlier than expected. Distributor B's revenues fall because its later-than-expected video releases shift business to A's movies. In this example, aggregate industry revenues fall from 8 to 7 in the SW quadrant due to less effective discrimination overall.

		Distributor B	
		6 mo.	2 mo.
Distributor A	6 mo.	4,4	2,5
	2 mo.	5,2	3,3

The industry equilibrium in this game is the SE quadrant, since whatever A's or B's decision, the dominant strategy is for the other firm to shorten its windows. In that quadrant, aggregate profits fall further to $3,3 = 6$, because of the still less efficient price discrimination with the now-fulfilled 2 month video window expectations. As in the standard prisoner's dilemma model, however, both distributors would obviously be better off if there were a way for them to stay in the NW quadrant.

Two assumptions implicit in this model are notable. One is that a unilateral move of one distributor from a 6 to a 2 month window increases its revenues due to the "surprise effect" by more than it reduces them due to less effective discrimination. While this is a questionable assumption in a 2 firm game, it is evident that as we increase the number of distributors, or consider only individual films, the surprise effect will eventually dominate as the marginal effect of a single decision on consumer expectations diminishes.

The second key assumption is that consumers do not blame either distributor A or B by identifying that particular distributor as most likely to offer shorter windows in the future. This appears to be a realistic assumption, somewhat peculiar to the movie industry. Perhaps with the exception of Disney, consumers generally do not attach brand

names to the movies they see. Instead, they appear to regard the industry as an amorphous whole, called "Hollywood."

Another mechanism the industry might use to enforce longer video windows is through the contracts they write with theaters, such as done in Austria (See Table 1). Theater operators have an obvious incentive to maintain long video windows, yet to our knowledge, theater exhibition contracts in the U.S. never contain such provisions. One likely factor working against such provisions is the high pre-release uncertainty of film performance (DeVany and Walls, 1996). As we discuss further, distributors may want to have a shorter window for films that do poorly in theaters. Also, theater ownership in the U.S. is fairly diverse, the largest circuit having only about a 15% share of box-office revenues, while video distribution is simultaneous nationally. Again, consumers do not appear to blame individual theaters for showing movies that might later appear on video sooner than they expected, reducing the incentives for individual theater operators to demand minimum video windows.

In the absence of contractual or other commitment mechanisms, the plausibility of some form of industry-wide coordination of the video window is suggested. National Association of Theater Owners (NATO) executives periodically issue calls in the trade press for distributors to adhere to a six month window, and when a distributor releases a major film with a substantially shorter video window, competing distributors may admonish them. In 1996, for example, the very successful films *Twister* and *Independence Day* were released by Warner Bros. and Fox, respectively, on video less than 5 months after their theatrical openings—an unprecedentedly short window for major films at the time. Following these incidents, NATO executives complained loudly in public and a Paramount Pictures executive made a sympathetic statement, saying in part “What we don’t want is to have the consumer think they can pick up a movie on video in three months.”³

In this preliminary paper, we follow the lead of the literature on bid rigging in auctions, by attempting to identify patterns in the data that suggest or imply industry collusion or coordination of some kind in the setting of video windows (Porter & Zona, 1993, 1999; Baldwin, Marshall & Richard, 1997). In particular, we might observe a

³ "Longer theatrical, video windows sought," *Video Business*, November 8, 1996, p. 6.

tendency for video windows to systematically cluster around one particular length, such as six months, irrespective of other economic factors. Or, we might observe a tendency for window coordination to have a pattern over time of breaking down, then becoming re-established, etc., due either to outside shocks or internal dissention. Finally, it may be that if members of an industry trade association are successful in maintaining video windows by collusive or other coordinated behavior, then firms that are not members of the trade association will behave differently. In European countries, at least, the industry agreements to maintain windows appear to be coordinated through industry trade associations. Thus, we might expect to observe non-MPAA members in the U.S. to opportunistically select shorter windows.

In the analysis to follow in this paper, we focus on possible differences in the behavior of MPAA-affiliated vs. independent distributors, using econometric models that account for the effects of other economic variables on window lengths. We consider the issues of window length consistency and stability over time as we introduce our database in Section V. below.

IV. The Basic Empirical Model

Equation (1) sets out the basic model we estimate:

$$(1) \text{ Video Window} = f(\text{VCR penetration, box-office performance, production cost, interest rate, distribution pattern, annual time of release, MPAA membership, interaction variables between dependent variables})$$

We hypothesize that the video window should depend negatively on VCR penetration. Frank (1994) shows theoretically that as video becomes a more important source of movie revenues relative to theatrical release—as it did over our study period—the industry's optimal window becomes shorter. The intuition of his result is that at equilibrium, the marginal tradeoff between increasing theater revenues and reducing video revenues by lengthening the window shifts in favor of video revenues as VCR penetration rises.

It is difficult to predict with certainty how a movie's box-office performance should affect window length, but it seems likely that there will be a positive relationship.

If high box-office performance drives a very long theatrical run, the result may simply be to push the optimal video window beyond the six month level.⁴ On the other hand, movies that do poorly at the box-office and leave the theater market quickly may benefit from quicker release to video if their ad campaigns lose impact more quickly or if people more easily forget about them. Such exceptions are common practice in Europe, as indicated for some countries in Table 1. In France, for example, distributors can apply for a "derogation" (a legal exemption from the one year minimum French video window), and poor box-office performance is a commonly claimed rationale (Paul Kagan Associates, 1994).⁵ Beyond these extreme cases, however, higher box-office performance of a given movie will affect video demand, negatively through substitution effects, but positively through quality signaling effects, with uncertain net results.

Among other variables, higher interest rates should tend to reduce the optimal length of the video window since it becomes relatively more expensive for distributors to wait for receipts paid back from the video release. Production investment may have a negative effect on the video window if capital markets are imperfect. That is, expensive movie production investments may put more pressure on distributors to receive funds sooner. Concerning distribution patterns, if a distributor elects to open a movie in a relatively large number of theaters nationwide, the movie may be expected to end its theater run more quickly, leading to a shorter window in order for the distributor to prevent consumers from losing their awareness of the movie and its ad campaign.

Consistent with our discussion above, we test the hypothesis that MPAA members will have longer windows than "independent" distributors. If some form of coordinated behavior among MPAA members prevails in the U.S., that is, MPAA membership would be positively related to window length, non-MPAA membership the opposite.

There are a variety of other factors that may affect the window, with uncertain direction. Certain genres or types of movies, for example, might benefit from quicker or

⁴ Frank (1994) shows this result formally, using a model in which videos are released spontaneously during the theatrical run. That is a relatively rare occurrence in practice, however, at least before the overwhelming majority of theater market revenues have been earned.

⁵ Note that legislated video windows in Europe may have another purpose, namely to protect theater owners from the competition of video release. In that case, the legislated window length is unlikely to be at an industry profit maximizing level. This is evidently the case in France, where a legally mandated video window of one year earns repeated complaints from the MPAA as excessively long.

slower release to video. Individual distributors may also have different management philosophies or opinions about optimal window length.

V. Database

Our primary database consists of 1429 theatrical movies released on videocassette between Jan. 1, 1988 and December 31, 1997. Our primary data source is the “A Title List,” maintained by *Video Store Magazine*, a leading trade publication. The A Title list includes 1833 movies released on videocassette or DVD during that period and selling at least 50,000 units at the wholesale level—thus including the great majority of theatrical films of economic significance. The *VSM* data are primarily collected by weekly survey of a large sample of video retailers and are intended to be comprehensive. The A Title List includes video distributor identification, video release date (“street date”), wholesale video revenues, and a variety of other information.

We supplemented these data with information from the A.C. Nielsen EDI electronic database. The EDI data cover virtually all movies released in theaters in the United States between 1982 and the current date, and include: theatrical distributor identification, release date, a production investment estimate, week to week box-office results for the duration of the movie’s theatrical run, the number of theater screens by week, and movie characteristics such as rating, genre, and cast principals. The EDI data are collected through a weekly survey of theatrical film distributors, supplemented by a statistical sample of weekend results from U.S. theaters, and are the primary source of entertainment industry data published in *Variety*.

A total of 205 of the 1833 “A title” movies were eliminated due to inconsistent or missing data identifying the theatrical or video distributor, theatrical or video opening dates, or weekly box-office information, leaving a total sample of 1628.

For our primary statistical analysis, we then excluded 182 movies that earned less than \$1 million at the box-office, or whose maximum weekly theatrical exposure did not reach at least 24 screens. Our reason for these restrictions was to eliminate films whose theatrical exposure was only nominal (180 films were under \$1 million box-office) or which were never given a substantial national theatrical release (75 films reached 23 or fewer screens). Although the levels of these restrictions are arbitrary, we made them in a

conservative attempt to insure that the video window definition was a meaningful one. In any case, we also tested a variety of models with the full data base, with little difference in results, as we discuss further below.

Finally, we eliminated cases in which the video window was in excess of 365 days (17 additional cases with windows of 368 to 2,552 days). Our rationale here is the likelihood that factors irrelevant to the economic process we are interested in will have intervened. Relatively minor films with very long windows, for example, might reflect inadequate financial resources of the distributor, or perceived changes in market conditions that formerly rendered a video release unviable.

All observations in the resulting final database of 1429 movies used for our primary analysis had complete data, except that 17 observations had missing data on the maximum number of screens reached in theatrical distribution, and 169 did not have production cost information.

Descriptive analysis of the video window

Table 2 shows basic data for the video window (WINDOW) over the 1988-1997 time period, based on the 1429 movie sample. The window has remained in relatively close range of a 180 day mean and median. Analysis shows that overall, there are significant differences among the 10 annual WINDOW means at the 1% significance level. A slight downward trend over time is also apparent.

Table 2 also shows considerable variation in window length for the movies released on video within each year. To illustrate, Figure 2 shows graphically the frequency distribution of WINDOW for the most recent year, 1997. Although the figure indicates a clustering around the mean of 174 days for that year, there are a number of relatively extreme values (recall that the few cases above 365 days are excluded) and the graph does not appear to indicate any minimum benchmark, such as 180 days, that the window consistently tends to exceed. The windows for 568, or approximately 40% of the sample movies, fell within plus or minus 10% of the overall median of 180.0 days.

Analysis showed significant overall differences in the annual variance of window lengths.⁶ Inspection of Table 2 indicates a marked decline in the variance from 1988 to at

⁶ Based on Bartlett's test for equal variance, chi-square (9) = 59.9, prob < .000.

least 1995. These data suggest the possibility of unstable window coordination by distributors over time, especially in early years, and thus invite further investigation.

Table 3 shows the relationship between video windows and theater run lengths. In contrast to WINDOW itself, there has been a clear upward trend in average theater run lengths (Col. (1)).⁷ This trend mostly disappears, however, when theater runs are measured by the perhaps more realistic definition of run length as the date by which 95% of the eventual total of box-office receipts have been received (Col. (2)). Thus, theater run lengths get a longer tail over the sample period, but there seems to be little trend in how long it takes for a movie to earn the overwhelming bulk of its theater receipts. Columns (3) and (4) of Table 3 show the average amount of time within the video window that the sample movies are unavailable to consumers, according to each of these definitions. The overall average of the “out-of-market” gap has been about 12 weeks by the former definition and more than 17 weeks using the 95%-of-receipts definition.

These data thus indicate a relatively long period of time--consistent in length over the sample period in terms of the “95% of boxoffice” definition--that movie distributors have typically withheld their movies from the marketplace in advance of their video release.

Regression model variables

The results of models that we report in Section VII below all use WINDOW as the dependent variable, along with various forms of the following independent variables:

VCR:	% household penetration of VCRs for the year of theatrical release
VCRYEAR__	dummy variable= 1 to indicate the year in which the movie was released on video (VCRYEAR88 to VCRYEAR97)
BOXTOTAL	total box-office receipts earned by the movie over the course of its theatrical run
MAXSCREEN	the maximum number of theater screens reached during the movie’s theatrical run

⁷ Theater run length is defined to be the total number of days after theater opening for which any revenues are reported by EDI. Data are reported only by one week intervals, and are thus lumpy to that extent.

REAL-INT	nominal 6 month T-bill rate of the FRB less the expected inflation rate, which is estimated on the basis of past inflation rates from 1960 to 1997
PRODCOST	estimated negative cost of the movie
IND-DUM	dummy variable = 1 if the movie has a non-MPAA theatrical distributor <i>and</i> a non-MPAA video distributor; = 0 otherwise
DISNEY, etc.	dummy variables to represent each of the seven major theatrical distributors. For example, DISNEY = 1 indicates a movies distributed theatrically by DISNEY or one of its corporate subsidiaries.

Basic descriptive statistics of these variables are shown in Table 4.

The use of data observations over a 10 year period is problematical due to changing industry conditions. At least to some extent, changes over time in the economic tradeoffs between theatrical and video release can be captured by the VCR penetration variable, for which we expect a negative sign as discussed above. Ostensibly, other technological and demand changes over this period seem to be relatively minor. PPV exhibition, whose window follows video, grew somewhat over this period and its windows were in flux. Even at the end of the period, however, PPV exhibition accounted for less than 1% of total movie distributor revenues, vs. approximately 47% for video (Paul Kagan Associates). The growth of DVD may have also affected window decisions, but DVD player penetration remained well under 1% of U.S. households by the end of the period and accounted for an insignificant proportion of video market retail volume. In some models, we nevertheless attempt to compensate for unknown structural changes over time by using a set of dummy variables (VCRYEAR__) to represent each of the individual years over which our sample is collected.

To represent box-office performance, we use the total box-office receipts of the movie over the full period of its theatrical run (BOXTOTAL). Movie distributors typically announce a video street date to the trade six to ten weeks in advance. For some films, the video release date is announced before the end of the movie's theatrical release. Ideally, we would use a variable representing the actual box-office performance of the

movie at the time that a window date decision is made or announced. A sample of announcement period information for 242 films released in theaters from 1994 to 1996, however, showed that only 10.3% of announcements were made at or before the week that 95% of eventual theatrical receipts have been earned--a point from which the distributor is undoubtedly able to make a very accurate estimate of the eventual box-office receipt total.⁸ Industry lore, in fact, is that movie executives or analysts are able to make reasonably close estimates of a film's box-office performance one or two weeks into a film's theatrical release.

To represent the movie's chosen distribution pattern, MAXSCREEN measures the point of widest market release: that is, the largest number of screens that the movie appears on in any part of its theatrical release. Other things equal, we expect that more widely distributed movies will leave the theater market sooner and have shorter windows.

For the interest rate, it is necessary to use a real rate (ie, corrected for inflationary expectations), because that represents to distributors the actual expected cost of postponing the video market receipts for the film. The variable REAL-INT is defined to be the nominal 6-month U.S. Treasury bill rate less the expected inflation rate. We statistically estimated the latter variable based on actual inflation in the past according to a time series estimation procedure set out by Davidson and MacKinnon (1985).

The IND-DUM variable indicates one of the four possible permutations of MPAA member involvement in the movie's theatrical and video releases. To specify this variable, we investigated the corporate affiliations and histories of the approximately 100 theatrical and video distributors having movies in the final database. For cases in which the company changed its status over time (e.g., it was acquired or sold by an MPAA member), the observations from the date of deal were coded as non-independent (MPAA member) or independent distributor. Removal from the database of hybrid cases (e.g., theatrical release by an MPAA member and video release by a non-MPAA member, or vice versa) proved to have virtually no effect on results, so these observations are left in the database as MPAA member-released films.

Table 5 shows that IND-DUM = 1 cases were a relatively small minority of the 1429 total sample. These independently distributed movies had somewhat shorter

⁸ These data were provided to us by the National Association of Theater Owners.

windows and theater runs, and to be expected, averaged much smaller budgets and box-office revenues, and were typically released to fewer theaters.

Production cost and box-office receipts are financial variables subject to inflation and related economic forces, used in a model that estimates a non-financial variable. As Table 4 indicates, there were substantial trends over time in at least the production cost variable. It is not clear how, if at all, that these variables should be deflated over time. We report models in which these variables are deflated using an index based on the mean value of the variable in each year, in order to eliminate annual trends entirely (BOXTOTAL-D, PRODCOST-D). We also estimated models in which these variables are annually deflated by the CPI and models that used their current \$ values.

We used logarithmic forms of the box-office revenue, production cost, and maximum screen variables to reflect an expectation of diminishing returns to their effects on window lengths.

Finally, we include interaction terms. One of these, REAL-INT x LN PRODCOST, is intended to reflect the expectation that if capital markets are imperfect, pressures to shorten windows to recoup costs of relatively expensive movies may be greater in times of high real interest rates. If so, this variable would have a positive sign. Finally, we test whether the effects of high real interest rates are greater for movies distributed by independent distributors compared to those of the major distributors, by using IND-DUM=0 x REAL-INT and IND-DUM=1 x REAL-INT in place of REAL_INT. Presumably, independent distributors have more meager economic resources, which may result in a negative, or more strongly negative, coefficient of IND-DUM=1 x REAL-INT vs. IND-DUM=0 x REAL-INT.

Table 6 below shows the correlation matrix of final variables.

VII. Regression Results

Table 7 shows ordinary least squares (OLS) results for a selection of basic models we tested. These models showed consistently significant levels of heteroskedasticity, based on the Cook-Weisberg test. GLS estimation of the models proved to show negligible differences, and we report only the OLS results.

We report four basic sets of results in Table 7. Models (1) and (2) do not include production cost variables, but are of interest because they allow a larger number of independently distributed (ie, IND-DUM=1) cases: 83 vs. 54 for other models. These missing data films tend to earn smaller box-office revenues, and by inference, are relatively inexpensively produced movies. Models (3) and (4) add production cost-related variables, and (5) and (6) replace VCR with the video release year dummy variables. In each of these three basic versions, the real interest is interacted with the IND-DUM=1/IND-DUM=0 distributor dummy variables to measure the extent to which imperfect capital markets may affect independently vs. MPAA member-distributed films differently. Models (7) and (8) show the effects of individual dummies for major distributors. All of these reported models use box-office and production cost variables de-trended by the annual averaging method. Results with current \$ and CPI-deflated variables showed no significant differences with those reported.

In all models, the VCR variable is strongly significant and in the expected direction, as found by Frank (1994) in his analysis of German data. Consistent with that interpretation, data from Paul Kagan Associates indicates that as VCR penetration has increased, the relative importance of box-office revenues to distributors declined from 36% of total domestic revenues in 1988 to 22% in 1997, while that of prerecorded video increased from 40% to 47% over the same period. To save space, the VCRYEAR__ dummy coefficients are not reported. In nearly all cases, these were insignificant.

The box-office performance measure (LN BOXTOTAL-D) is significant in all the models, in the expected directions (also consistent with Frank's German findings), while more widely distributed movies (higher LN MAXSCREEN) tend to have consistently shorter runs as hypothesized.

Turning to financial market related variables, the coefficient on production costs (LN PRODCOST-D) is consistently negative and significant. The coefficient on the interest rate variable (REAL-INT) is negative and significant in two of the four models where it appears directly (Models (3) and (7)). The interaction of the interest rate with production cost (REAL-INT x LN PROD-COST-D), had a consistently positive sign. Overall, these findings support the hypothesis that imperfect capital markets in the movie industry negatively affect video windows.

For all six models in which the IND-DUM=1 dummy variable appears, its coefficient is negative, showing that non-MPAA affiliated movies tend to have windows that are shorter than MPAA distributed films. Note, however, that when the IND-DUM=1/IND-DUM=0 dummies are interacted with the real interest rate (models (2), (4) and (6)), the coefficient on IND-DUM=0 diminishes from its 21 to 26 day estimated range, and becomes marginally insignificant (Models (1), (3) and (5)). In these cases, the generally more negative and significant coefficients for the IND-DUM=1 x REAL-INT interaction terms suggest that at least some of the shortfall in video windows of independently distributed films might be accounted for by the stronger capital market pressures that independently distributed movies are likely to face.

Notice finally from Model (7) and (8) that all the individual major distributors tend to have windows that are not only greater than those of independently distributed movies, but that these average window lengths vary for the different distributors. These differences may suggest different beliefs or philosophies of window setting by these companies, or they may reflect different, unknown characteristics of the movies they distribute, variables about which we unfortunately have little information.

It is notable that none of our models explain a very substantial proportion of the total variance in video windows, their adjusted R-squares remaining in a narrow range of .12 to .16.

The basic pattern of results reported is generally robust to alternative specifications or definitions of the data base. Note from Table 5 above, however, that some of the independent variables, notably MAXSCREEN and PRODCOST-D, and also BOXTOTAL-D and PRODCOST-D are correlated, and undoubtedly have cause and effect relationships. When we dropped the \$1 million box-office/24 screen minimum restrictions, thus adding 175 movies to the sample, including an additional 55 independently distributed (IND-DUM=1) movies, only marginal differences in coefficients or levels of significance emerged. We also estimated models that excluded the 1988 and 1989 periods of highest variance in window lengths to account for the possibility of structural change over time. These estimates generally produced somewhat weaker results and somewhat smaller differences in windows between MPAA and non-MPAA distributed movies, but the signage and statistical significance of coefficients did

not change. Finally, we attempted to account for seasonality effects by including variables for the month of release, but these steps generally did not improve results.

VIII. Summary and Discussion

The analysis of this paper shows that over a ten-year period from 1988 to 1997, while the average video window of U.S. distributed movies declined slightly, it has remained in the 180 day range. The median window has remained very near the mean and tends to cluster at the mean level. Actual video windows for individual movies show a fairly wide dispersion in any given year, though, and that variance has fallen over time, at least up to 1995.

Overall, our regression results are consistent with expectations, indicating that VCR penetration has negatively affected window lengths, higher box-office performance tends to increase windows, and movies having wider theatrical distribution patterns tend to have shorter windows. Generally negative effects of production costs and interest rates on video windows suggest the likely significance of capital market factors in video window setting.

Our regression models show that movies released by non-MPAA affiliated movie distributors have significantly shorter video windows. This finding is consistent with our hypothesis that independents may be under less pressure to maintain any minimum window restrictions that may be coordinated by the MPAA or NATO organizations. Our estimates also showed, however, that these window length differences diminish and tend to lose statistical significance when the presumably greater capital market pressures of higher interests on independent firms are taken into account. We also note that the proportion of variance in windows explained by any of our models is relatively low. On the one hand, we should expect a wide range of unexplained variance because of random factors; individual distributors, for example, engage in a pre-video release exercise of floating trial video street dates and shifting them interactively in response to others' gambits, etc. We cannot be certain, however, that variables not in the model, or the inexact specification of variables forms, do not bias our findings with respect to the behavior of independent distributors. Thus, our results are not conclusive at this stage. We are continuing to refine our analysis of the behavior of independents, including an

investigation of how windows for different types or genres of films may tend to differ, and also separation of the sample into shorter time segments.

Overall, the relative consistency of window levels over time--and the relatively long "out-of-market" intervals in the case of most movies (including independently distributed films) between the end of their theater runs movies and their availability on video--suggests that movie distributors and exhibitors are somehow successful in maintaining a consistent window that largely avoids myopic, destructive behavior by individual distributors. Thus, American distributors appear to cope with the time consistency problem reasonably well. Presumably, that degree of success is in the public interest, leading to a level of product variety perhaps not much different than that which could be maintained by an industry able to overtly coordinate window lengths.

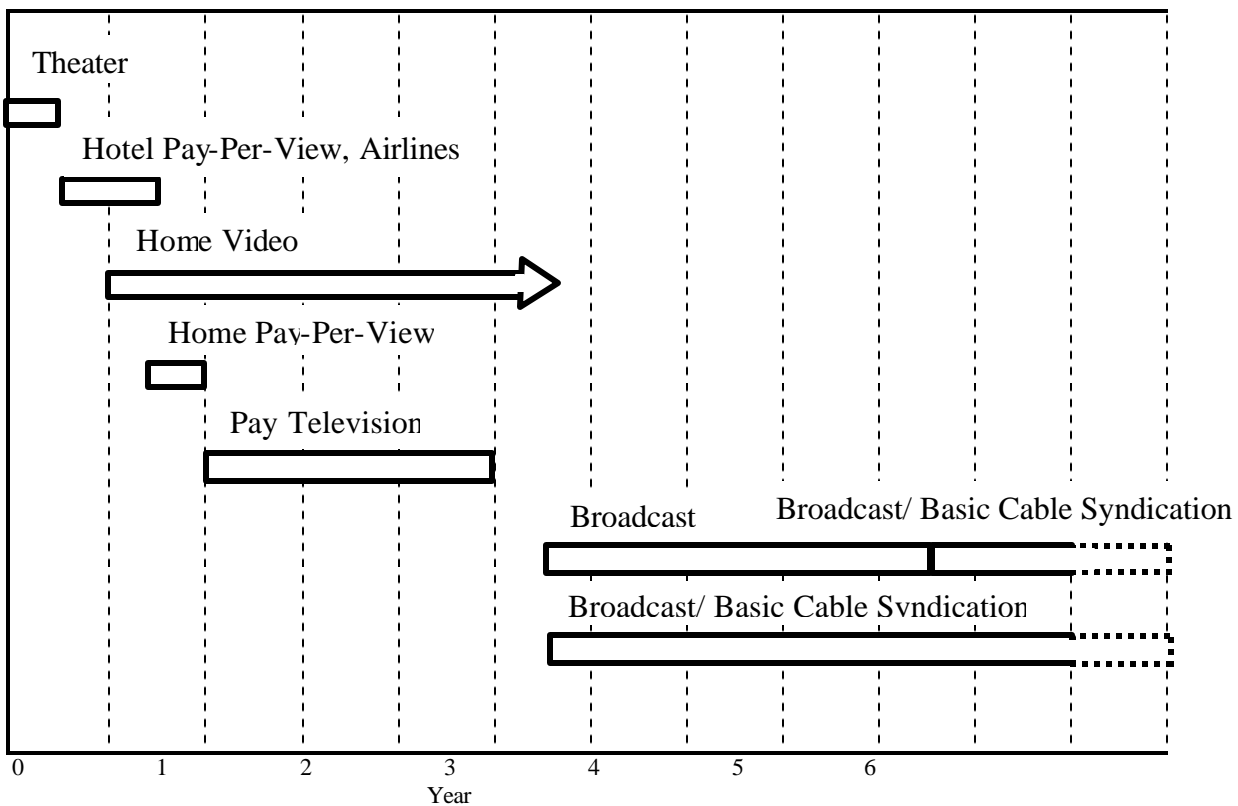
The next major step in our research is to investigate explicitly whether the movie industry as a whole is successful in limiting the deterioration of video windows below some industry optimum, or at least preventing them from reaching competitively determined levels. For this purpose, we are proceeding to compare the empirical predictions of two main alternative models. The "coordination model" tests the hypothesis that windows coalesce around some specific level, such as 180 days, without regard to economic factors. The "competitive model" tests the hypothesis that the industry sets windows according to some competitive process, that is, a process in which window decisions involve only the video street date's effects on theater audiences for the same movies, along with relevant economic variables. The relatively long period which some movies are completely out of the marketplace, especially movies that close their theater runs fairly quickly, suggests that the "coordination" model has some credence.

Table 1. Video Windows in Europe (1994-96)

Country	Mo.	Window setting method
Austria	6	industry agreement (fixed by contract for each release)
Belgium	6	industry agreement (follows French and Dutch patterns)
Denmark	6	industry agreement
France	12	statute (12 months by law, but 6 months if total box-office admissions are under 100,000; if admissions under 400,000, a derogation may be applied for)
Germany	6	industry agreement ("voluntary," but 6 months is mandatory for state-subsidized films; distributors "nearly always stick" to the 6 months on non-subsidized movies.
Greece	6	industry agreement
Ireland	6	industry agreement
Italy	8	statute/industry agreement (until 1994, one year; set at 8 months by law in 1994, with conditions set for derogations.
Netherlands	6	industry agreement
Norway	6	industry agreement ("strictly adhered to")
Portugal	12	statute
Spain	6	industry agreement (fixed on a case-by-case basis within guidelines: mandatory 6 months on subsidized films until 1996, when shortened from 6 to 4 months
Sweden	6	industry agreement ("fairly relaxed")
Switz	4-6	industry agreement ("not compulsory")
UK	6	industry agreement

Source: Paul Kagan Associates, *Kagan's European Home Video, 1994*; *Euromedia Regulation*, Feb. 21, 1996.

Figure 1. Typical Domestic Theatrical Release Sequence



Source: Compiled by authors from trade literature sources.

Table 2. The Video Window: Descriptive Statistics (number of days)

Video year	Obs	Mean	Median.	Variance	Var/Mean
1988	120	185.6	191.0	3163.9	17.0
1989	134	198.5	194.0	2578.1	13.0
1990	130	187.4	183.5	2082.6	11.1
1991	136	185.2	175.5	2095.5	11.3
1992	132	189.7	187.0	1778.6	9.4
1993	142	186.1	184.5	1813.1	9.7
1994	156	180.9	177.0	1233.8	6.8
1995	142	180.6	179.0	1145.9	6.3
1996	164	179.8	179.0	2030.0	11.3
1997	173	174.5	172.0	1488.8	8.5
Overall	1429	184.3	180.0	1930	10.5

Table 3. Mean and Median of Window-Related Variables (number of days)

Video year	Theater open to theater close		Theater open to 95% of box-office*		Theater close to video release		95% of box-office* to video release	
	mean	median	mean	median	mean	median	mean	median
1988	84.8	70.0	60.8	49.0	100.8	101.5	124.8	123.5
1989	84.9	70.0	58.6	49.0	113.6	117.0	140.0	137.0
1990	93.6	84.0	59.8	49.0	93.8	95.0	127.6	122.0
1991	102.2	84.0	64.3	56.0	83.0	94.0	120.9	123.0
1992	96.8	98.0	63.7	63.0	92.9	94.5	125.9	124.5
1993	100.5	94.5	64.9	56.0	85.6	83.0	121.1	117.0
1994	100.1	94.5	60.6	56.0	80.8	82.0	120.3	117.0
1995	119.4	112.0	64.5	56.0	61.3	67.0	116.1	123.0
1996	114.1	101.5	56.9	49.0	65.8	67.0	122.9	122.5
1997	116.8	112.0	60.5	49.0	57.6	60.0	114.0	116.0
Overall	102.3	91.0	61.4	56.0	82.1	83.0	123.0	123.0

* 95% of box-office: the date by which 95% of the movie's eventual total box-office receipts have been earned.

Figure 2: Frequency Distribution of the Video Window

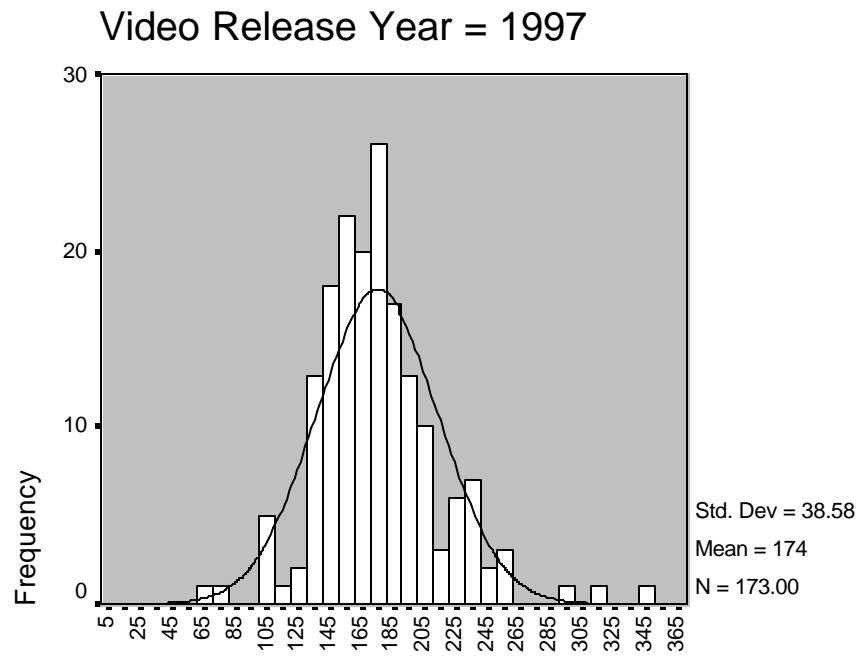


Table 4. Descriptive Statistics for Basic Independent Variables

Variable	Mean	Median	Std. Dev.	Min	Max
VCR	69.1	-	-	-	-
1988	50.6	-	-	-	-
1989	58.9	-	-	-	-
1990	63.6	-	-	-	-
1991	66.3	-	-	-	-
1992	68.7	-	-	-	-
1993	70.9	-	-	-	-
1994	72.2	-	-	-	-
1995	74.2	-	-	-	-
1996	77.5	-	-	-	-
1997	79.6	-	-	-	-
BOXTOTAL	27.2	15.3	34.7	1.0	312.2
1988	23.0	13.8	28.1	1.2	164.2
1989	24.9	11.8	34.8	1.1	251.2
1990	23.3	12.4	28.3	1.1	138.1
1991	30.6	15.6	43.3	1.0	281.6
1992	27.0	16.4	31.0	1.0	162.8
1993	27.3	14.4	31.6	1.1	172.7
1994	21.6	15.3	21.2	1.2	102.2
1995	28.5	17.5	38.2	1.0	312.2
1996	29.5	17.2	36.3	1.0	241.7
1997	33.8	18.1	43.5	1.0	260.3
MAXSCREEN	1294.9	1307.5	673.6	25.0	3565.0
1988	1042.4	1117.0	488.2	49.0	2562.0
1989	1073.6	1118.0	543.5	54.0	2837.0
1990	1098.3	1095.0	583.5	31.0	2332.0
1991	1191.0	1230.5	579.6	75.0	2509.0
1992	1186.2	1223.0	619.1	25.0	2644.0
1993	1324.4	1391.0	606.2	25.0	2491.0
1994	1315.9	1406.5	648.4	126.0	2748.0
1995	1422.7	1491.5	697.7	40.0	2893.0
1996	1543.5	1635.0	684.6	34.0	3012.0
1997	1567.5	1745.0	871.9	49.0	3565.0
REAL_INT	1.9	2.3	1.8	-1.3	5.5
1988	2.9	2.8	0.4	2.5	4.0
1989	4.6	4.6	0.7	2.5	5.5
1990	4.1	4.1	0.3	3.6	5.5
1991	2.6	2.8	0.9	0.6	4.1
1992	0.2	-0.1	0.7	-1.3	1.5
1993	-1.1	-1.1	0.2	-1.3	-0.4
1994	-0.3	-0.6	0.7	-1.1	1.4
1995	2.3	2.6	0.6	1.0	3.0
1996	2.2	2.2	0.2	1.8	2.6
1997	2.3	2.2	0.1	2.1	2.5
PRODCOST	21.8	17.0	18.1	0.0	175.0
1988	13.5	12.0	9.3	1.7	58.0
1989	14.1	14.0	7.5	2.0	50.0
1990	16.0	13.0	11.0	0.5	55.0
1991	20.3	17.0	14.7	0.3	95.0
1992	20.1	16.5	14.0	2.5	80.0
1993	20.7	18.0	12.4	2.5	65.0
1994	23.2	20.0	15.5	3.0	77.0
1995	27.2	23.5	19.8	0.0	90.0
1996	29.8	24.0	24.2	0.0	175.0
1997	33.6	25.0	28.8	0.3	145.0

Table 5. Characteristics of MPAA and Non-MPAA distributed Movies

Variable	IND-DUM=1		IND-DUM=0		ALL	
	Obs	Mean	Obs	Mean	Obs	Mean
WINDOW	83	168.0	1346	185.3	1429	184.3
THEATER OPEN TO THEATER CLOSE	83	93.8	1346	102.8	1429	102.3
THEATER OPEN TO 95% OF BOX	83	65.1	1346	61.1	1429	61.4
THEATER CLOSE TO VIDEO	83	74.2	1346	82.5	1429	82.1
95% OF BOX TO VIDEO	83	102.9	1346	124.2	1429	123.0
PRODCOST	54	8.1	1108	22.5	1162	21.8
BOXTOTAL	83	6.7	1346	29.6	1429	28.3
MAXSCREEN	83	669.4	1329	1334.0	1412	1294.9

Table 6. Correlation Matrix of Key Variables

	WINDOW	VCR	IND-DUM	REAL-INT	LN MAXSCREEN	LN PRODCOST-D
WINDOW	1.000					
VCR	-0.156*** 0.000	1.000				
IND-DUM	-0.092*** 0.001	-0.089*** 0.001	1.000			
REAL-INT	0.045 0.090*	-0.371*** 0.000	0.038 0.155	1.000		
LN MAXSCREEN	-0.126*** 0.000	0.143*** 0.000	-0.266*** 0.000	-0.059** 0.027	1.000	
LN PRODCOST-D	-0.014 0.644	-0.066** 0.025	-0.193*** 0.000	-0.012 0.676	0.503*** 0.000	1.000
LN BOXTOTAL-D	0.133*** 0.000	0.058** 0.029	-0.255*** 0.000	-0.065** 0.014	0.685*** 0.000	0.454*** 0.000

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

Table 7. OLS Results

Dependent Variable = Window				
VARIABLE	Model 1	Model 2	Model 3	Model 4
CONSTANT	338.22 (24.4) ***	337.71 (24.3) ***	356.18 (20.8) ***	353.09 (20.4) ***
VCR	-0.66 (-4.7) ***	-0.67 (-4.8) ***	-0.72 (-4.5) ***	-0.73 (-4.6) ***
IND-DUM	-20.89 (-4.3) ***	-11.29 (-1.5)	-25.56 (-4.3) ***	-16.85 (-1.7) *
REAL-INT	0.15 (0.2)		-9.34 (-2.7) ***	
IND-DUM=1 X REAL-INT		-3.98 (-1.6)		-11.57 (-2.9) ***
IND-DUM=0 X REAL-INT		0.40 (0.6)		-8.13 (-2.3) **
LN BOXTOTAL-D	14.22 (11.2) ***	14.16 (11.1) ***	14.76 (10.3) ***	14.67 (10.2) ***
LN MAXSCREEN	-20.95 (-11.5) ***	-20.79 (-11.4) ***	-18.93 (-8.5) ***	-18.77 (-8.4) ***
LN PRODCOST-D			-8.71 (-3.2) ***	-8.02 (-2.9) ***
IND-DUM X LN PRODCOST-D			2.80 (2.8) ***	2.49 (2.4) **
adj. R2	0.1276	0.1289	0.1273	0.1275
F	42.29 ***	35.79 ***	25.2 ***	22.21 ***
N	1412	1412	1162	1162

*** significant at 1% level, ** significant at 5% level, * significant at 10% level
(continued)

Dependent Variable = Window

VARIABLE	Model 5	Model 6	Model 7	Model 8
CONSTANT	299.89 (19.0)***	296.05 (18.4)***	346.61 (20.8)***	285.23 (18.6)***
VCR			-0.79 (-5.0)***	
VCRYEAR-*	(a)	(a)		(a)
IND-DUM	-25.18 (-4.2)***	-15.93 (-1.6)		
REAL-INT	-5.94 (-1.5)		-7.51 (-2.2)**	-3.73 (-0.9)
IND-DUM=1 X REAL-INT		-8.27 (-1.8)*		
IND-DUM=0 X REAL-INT		-4.60 (-1.1)		
LN BOXTOTAL-D	15.53 (10.7)***	15.43 (10.6)***	14.20 (10.0)***	15.08 (10.5)***
LN MAXSCREEN	-19.63 (-8.8)***	-19.44 (-8.7)***	-19.91 (-9.0)***	-20.62 (-9.7)***
LN PRODCOST-D	-8.67 (-3.2)***	-7.94 (-2.8)***	-7.2 (-2.7)***	-7.24 (-2.7)***
IND-DUM X LN PRODCOST-D	2.74 (2.7)***	2.40 (2.3)**	2.34 (2.4)**	2.27 (2.3)**
DISNEY			33.59 (6.8)***	33.25 (6.7)***
FOX			12.92 (2.5)**	12.87 (2.4)**
MGM			16.92 (2.9)***	17.20 (2.9)***
PARAMOUNT			29.13 (5.3)***	28.98 (5.2)***
SONY			16.84 (3.6)***	16.96 (3.6)***
UNIVERSAL			7.73 (1.4)	7.16 (1.3)
WARNER			9.70 (2.1)**	9.14 (1.9)*
adj. R2	0.1249	0.1252	0.1601	0.1586
F	12.05***	11.38***	18.03***	11.42***
N	1162	1162	1162	1162

*** significant at 1% level, ** significant at 5% level, * significant at 10% level

(a) All VCRYEAR- dummy variables except VCRYEAR88 appear in Models (5), (6) and (8). Of three models above, only VCRYEAR93 and VCRYEAR94 in Model (8) show significance at the 10% level.

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