

Optimal Timing of Movie Releases in Ancillary Markets: The Case of Video Releases

BJÖRN FRANK

University of Hohenheim, Germany

Abstract. The optimal time for the release of a film in the video market is derived theoretically and shown to depend on characteristics of its cinema performance and on several other parameters. It is empirically confirmed that the model can explain the changing film release patterns in the years of video market growth. The model can also be applied to other ancillary markets for motion pictures as well as to paperback releases of books.

Key words: ancillary markets, film marketing, video

1. Introduction

Whenever a film has the chance to be released successfully in the cinema, this release is its première. Releases in the ancillary markets follow: video, pay TV and free TV. In fact, due to a lower degree of excludability, a première in one of these secondary markets would be suicidal, similar to starting an intertemporal price discrimination by setting the lowest price. Moreover, a cinema première is also likely to attract more public attention than a TV première, for example. Thus, unlike the third-run cinemas, the first-run theatres are not likely to be endangered by the dynamics of ancillary markets.

In this paper, not the release sequence itself, but the release dates will be analysed. The period of time between cinema première and video release, henceforward called *period of exclusiveness*, will be taken as an example. Consideration of cinema and video release only implies no loss of generality. Remarks on the applicability to the complete four-tier-release pattern for theatrical movies (and on books as well) will be made in the concluding section.

2. The Model

Presuming that t_x^* is an optimal time for the video-release of a given film and only one such juncture exists, what would be the consequence of deviation from t_x^* ? If the film is released on video too early, the sub-optimality results from people being kept away from cinema because they can see the film at home. If the period of exclusiveness is too long, then sub-optimality results from people no longer interested in renting or buying the video cassette simply because (in terms of its cinema première) the film is too old.

Consequently, for a deviation of t_x^* , we consider the demand for a film as explicitly dependent on the variable time.¹ Let us begin with the demand for movies in cinemas, where strong empirical evidence shows that demand and the revenue are monotonically decreasing with time.²

We presume for the moment that there is no video release at all. Thus, we speak of *potential revenue* (PR) in the cinema market. For what follows, we need to specify the functional form of PR per time period as dependent on time (t): the potential-revenue-function. For mathematical convenience, we assume $PR(t)$ is linear³:

$$PR_c = m_c - s_c \cdot t \quad m_c, s_c > 0.$$

The subscript c denotes the phase of release (cinema). For $t \geq m_c/s_c$, there are no more returns from the cinema market. To simplify matters, m_c and s_c carry no subscript denoting the film considered, though it is clear that these parameters differ from each other for different films. Some films make about 40 per cent of their box-office returns in the first week, whereas others, so-called "sleepers" need months to reach this level.

Now we consider the consequence of a release on video in t_x ($t_x < m_c/s_c$). In this case, the actual revenues the film can still obtain in cinemas thereafter is only a share $(1 - \delta)$ of PR_c . This is due to the fact that some people who would otherwise have consumed the film in a cinema now prefer to buy or rent the video cassette. It is clear that $0 \leq \delta \leq 1$. Its magnitude will depend on the substitutability of cinema and video.

Figure 1 shows the opportunity costs in the cinema market resulting from a video release in t_x . These opportunity costs are represented by the hatched area. The aggregated potential revenue is the complete area between the graph and horizontal and vertical axis.

As soon as the film is shot, the producer's costs are largely independent of the number of consumers. Thus, for a given budget,⁴ the maximization of profits is identical to the maximization of revenues. Maximization of revenues can obviously be achieved by minimizing opportunity costs.

The minimization problem would be clearly trivial if only the opportunity costs in the cinema market, OC_c , were to be minimized. The video would be released when there is no one left who could thereby be kept away from the cinema.

Yet the choice of t_x , as we mentioned above, also determines the opportunity costs in the video market.

We construct now a potential-revenue-function for the video market, denoted by subscript v :

$$PR_v = m_v - s_v \cdot t \quad m_v, s_v > 0.$$

For PR_v it is presumed that the video release happens at the same time as the cinema release. The date for the video release is t_x , though. It is clear that some consumers would have preferred video if the required film had been available on

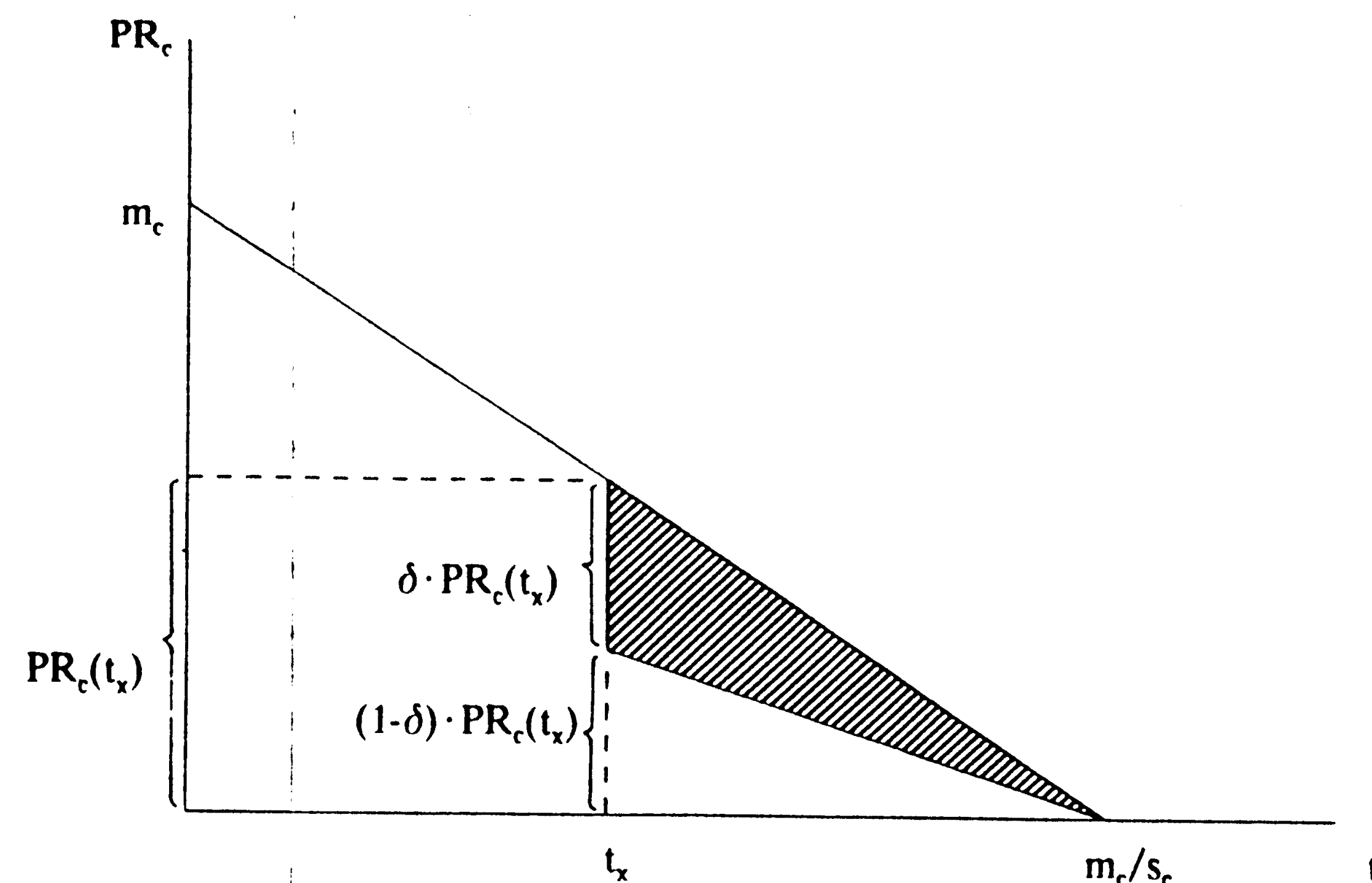


Fig. 1. Opportunity cost of a video release in the cinema market.

video before t_x . A share $(1 - \gamma)$, with $0 \leq \gamma \leq 1$, of these consumers wait until the film is available on video.

The difference between potential and actual revenues arises because there is a period of exclusiveness ($t_x > 0$). A share γ of potential video consumers is lost, either because they see the films in the cinema, or they completely lose interest in the film.

The opportunity costs in the video market of release at t_x , denoted OC_v are represented by the hatched area in Figure 2.

OC_v increases monotonically within the relevant range between 0 and m_v/s_v . (The longer the period of exclusiveness, the larger the hatched area.)

Figure 3 shows $OC_c(t_x)$, $OC_v(t_x)$ and $OC(t_x)$, which is defined as the sum of $OC_c(t_x)$ and $OC_v(t_x)$. We are looking for the t_x which minimizes OC . Analysing the determination of t_x and changes in t_x requires that the film is actually released both in cinemas and on video, i.e., OC has to have a minimum between 0 and m_c/s_c .

A parameter constellation thus has to be avoided in which a video release is never profitable. The sufficient condition to guarantee a video release is:

$$\text{Assumption I: } m_v/s_v > m_c/s_c$$

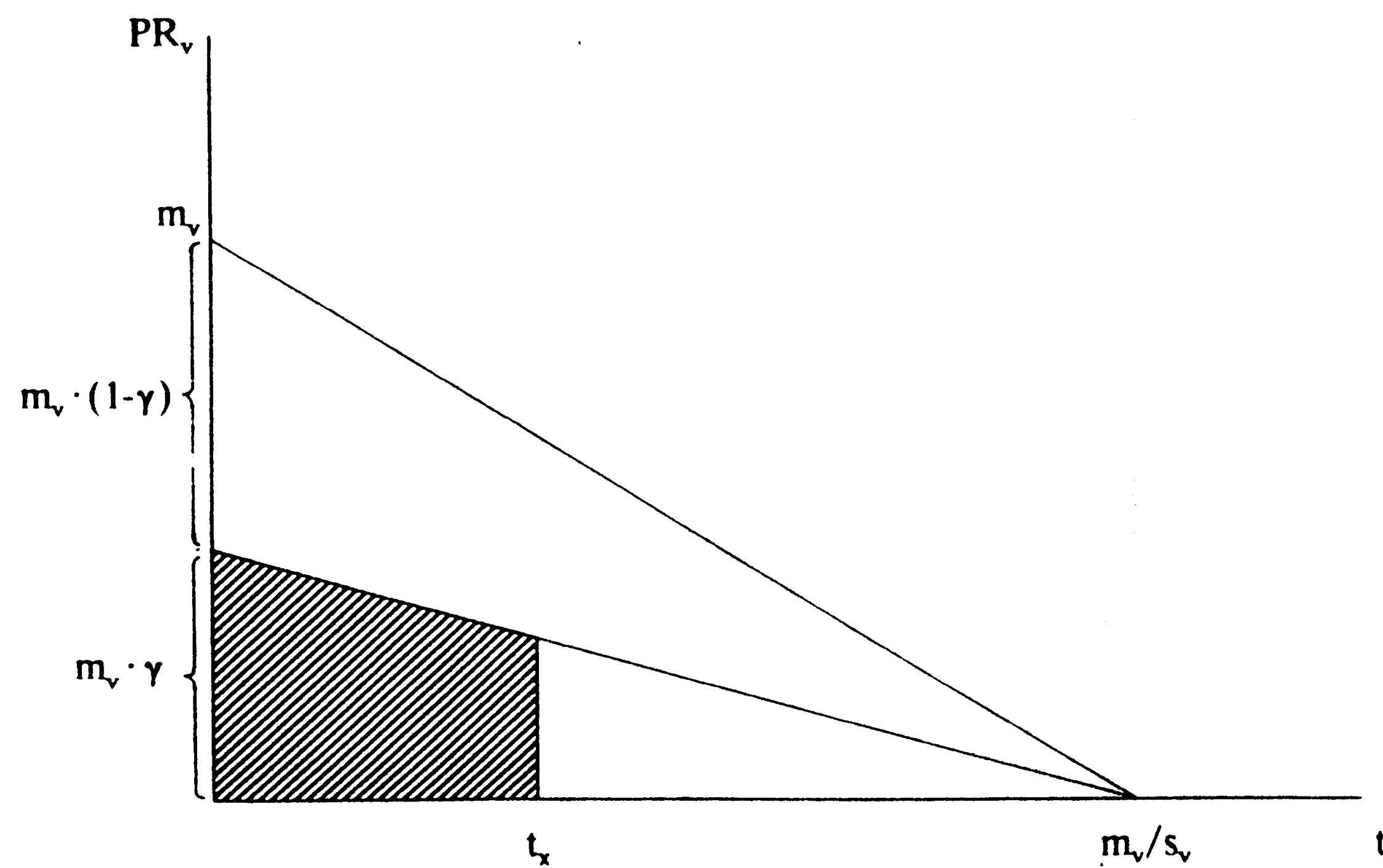


Fig. 2. Opportunity cost of a delay of the video release.

It is assumed that when demand for a film approaches zero, it is still consumed on video. This is clearly a realistic assumption.

We also want to avoid the extreme condition, where $t_x = 0$. We therefore make the following assumption:

$$\text{Assumption 2: } \delta \cdot m_c > \gamma \cdot m_v$$

Without this assumption, a video release at $t = 0$ could be optimal, which would mean $OC_v|_{t=0} > OC_c|_{t=0}$.⁵

After calculating OC explicitly (by integration or simple geometry), from the necessary condition for a minimum, $\partial OC / \partial t_x = 0$, we obtain:

$$t_x^* = \frac{\delta \cdot m_c - \gamma \cdot m_v}{\delta \cdot s_c - \gamma \cdot s_v}, \quad (1)$$

where t_x^* denotes the optimized t_x . This optimal value is always a minimum under the assumptions 1 and 2 made above.

3. Reasons for Changes in the Length of the Period of Exclusiveness

We now derive some comparative-static results. First we consider changes of t_x^* when the parameters of the potential-revenue-function in the video market change.

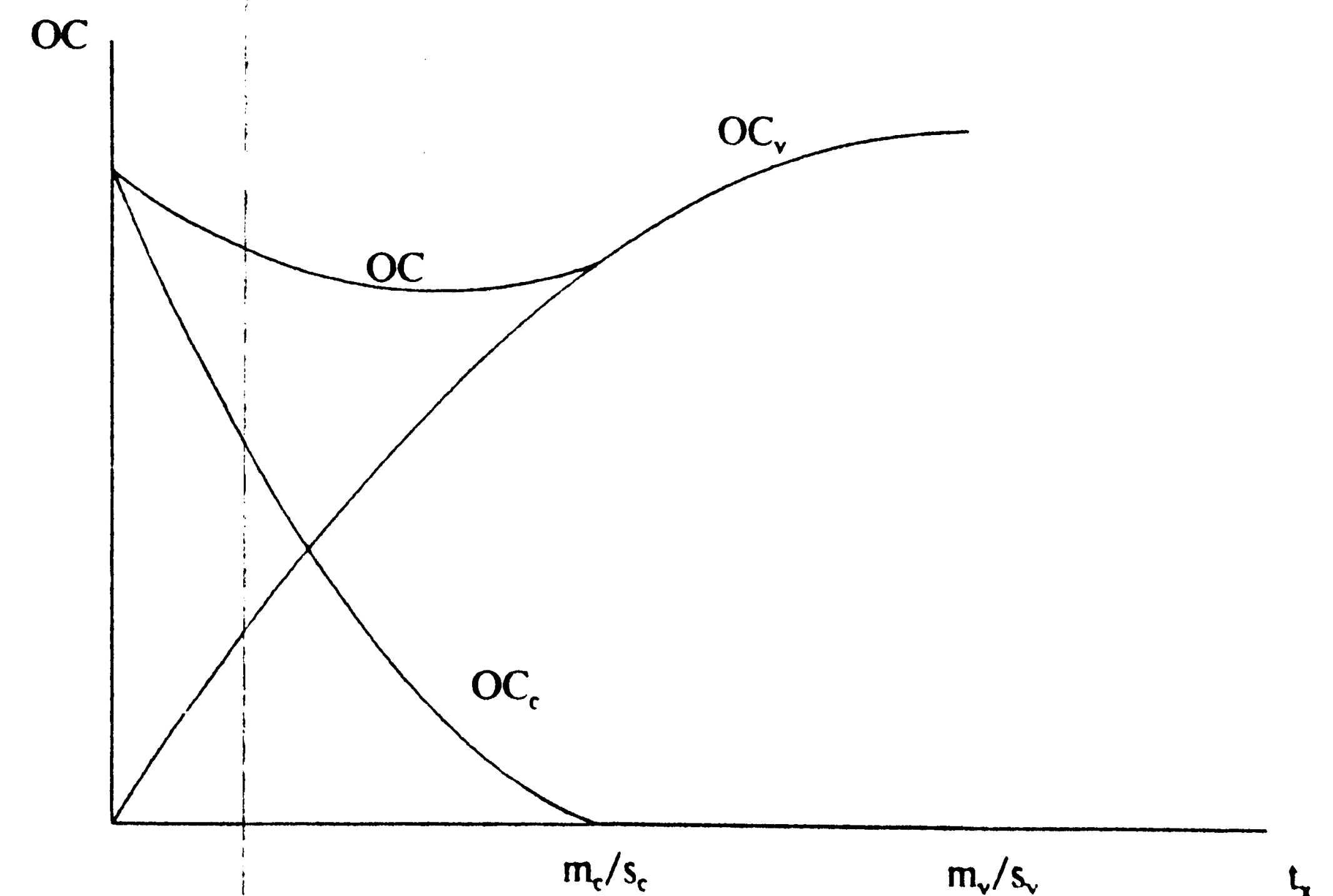


Fig. 3. The minimization problem.

(The question is: Was the growing video market of the last decade a good reason for the industry to shorten the period of exclusiveness?)

From (1) we obtain $\partial t_x^* / \partial m_v < 0$ and $\partial t_x^* / \partial s_v > 0$. In the first case, the revenue-potential-curve is shifted parallel. In the second case, the intersecting point with the vertical axis remains unchanged, but demand decreases more slowly (or faster). In both cases, if the revenue potential of a film in the video market increases, the period of exclusiveness becomes shorter. The intuition is that in the video market a higher revenue potential leads to higher opportunity costs of release for any t_x , thereby leading to a shift downward of t_x^* .⁶ One reason for a shift in the revenue potential might be a higher degree of saturation of households with video recorders.

Correspondingly, for changes in the cinema market we have $\partial t_x^* / \partial m_c > 0$ and $\partial t_x^* / \partial s_c < 0$. From equation (1), we also obtain $\partial t_x^* / \partial \gamma < 0$ and $\partial t_x^* / \partial \delta > 0$. (The higher δ , the higher the opportunity cost of a video release in the cinema market, because thereafter more people lose interest in seeing the film in the cinema.)

Finally, we compare the t_x^* of two films of different success denoted by superscripts 1 and 2. Let film 2 be more successful than film 1 in such a way that for every t , the revenue of film 2 is higher than the revenue of film 1 by a factor $\lambda > 1$. Let this hold in both the cinema market and in the video market, as box office

hits rarely fail in the video stores. Therefore, $m_c^2 = \lambda \cdot m_c^1$ and $m_v^2 = \lambda \cdot m_v^1$, so that the result is:

$$t_x^{*2} = \frac{\delta \cdot \gamma \cdot m_c^1 - \gamma \cdot \lambda \cdot m_v^1}{\delta \cdot s_c^1 - \gamma \cdot s_v^1} = \lambda \cdot \frac{\delta \cdot m_c^1 - \gamma \cdot m_v^1}{\delta \cdot s_c^1 - \gamma \cdot s_v^1} = \lambda \cdot t_x^{*1}.$$

More successful films, *ceteris paribus*, are thus released later on video. This holds despite of the fact that, for any relevant t_x , opportunity costs in the video market increase, as well as in the cinema market.

4. Data and Empirical Results

The results derived so far might help explaining (and predicting) changes in the film release patterns. An empirical test below, using German data, will show whether the model is suitable for this purpose. For four variables of the model it is possible to observe empirical counterparts which can be examined using multiple regression analysis.

The dependent variable of the regression is t_x . Our measure for t_x is the number of weeks between cinema and video release.⁷ The regression includes a subsample of 91 films (from a potential sample of 170 films), using only those cases where $t_x \geq 30$. This insured that a gentlemen's agreement between the distributor's and cinema's associations, aiming at a minimum of $t_x = 6$ months (von Hartlieb, 1991) would not lead to a bias. (Of course there are still many films released on video less than 6 months after the cinema première, as the agreement allows exceptions and lacks binding force, which antitrust laws would not allow.)

The first explanatory variable is the cinema attendance of a film in the first two weeks in about 20 per cent of West German cinemas.⁸ This variable is denoted M , and serves as a proxy-variable for m_c .⁹ In our model, a higher point of intersection with the vertical axis causes a longer period of exclusiveness. In other words, the theoretical expectation is that t_x increases with M .

The second explanatory variable is S . If $M10$ is the cinema attendance in the first 10 weeks after the premiere, then S is defined as $(M10 - M)/M10$. The higher S , the smaller the week-by-week decrease of demand. The variable S can be seen as proxy for $-s_c$. The theoretical expectation is that t_x increases with S .

The third explanatory variable is T . This is simply the week of cinema release, with the week from 2.1–8.1. 1984 = week 1, the week from 9.1. – 15.1. = week 2 etc. The films in our sample were released from 1984 to 1988, when the German video market grew monotonically.¹⁰ For these years, T is one main determinant, and the only observable one, of the revenue-potential in the video market (or of m_v and s_v , respectively).

In our model, a growing video market increases the opportunity costs of holding back the video release. Thus, we expect a negative sign on the regression coefficient for T . For an OLS regression of t_x on M , S and T , a White-test showed that the

hypothesis of heteroskedasticity could not be rejected. This might be due to the use of proxy variables (Kmenta 1986, p. 579).

Taking the logs of all variables is one method to correct for heteroskedasticity. The corresponding equation was estimated as follows:

$$\begin{aligned} \ln t_x = & 5.213 + 0.0380 \ln M + 0.104 \cdot \ln S - 0.326 \cdot \ln T \\ & (16.47) *** (2.20) ** (2.05) ** (-6.46) *** \\ R^2 = & 0.35 \end{aligned}$$

(The t-statistics are in parentheses; the level of significance is denoted ***: 1%, **: 5%, *: 10%; there are 87 degrees of freedom).

Another method to estimate a consistent covariance matrix is suggested by White (1980). Applying his procedure gave the following estimates

$$\begin{aligned} t_x = & 48.321 + 0.0238 \cdot M + 8,954 \cdot S - 0.0988 \cdot T \\ & (8.80) *** (1.76)* (2.15) ** (-2.91) *** \\ R^2 = & 0.28 \end{aligned}$$

A critical number of 10.69 for this regression, and 38.10 for the log-linear equation, respectively, does not indicate that there is a problem of multicollinearity (Belsley, Kuh und Welsch, 1980). As a result, the regression analysis supports the theoretical analysis of the preceding sections. All variables are significant and have the expected signs.

5. Discussion

It has been explained theoretically and shown empirically for Germany that a growing video market shortens the period of exclusiveness, the period of time between cinema première and video release.

So far we have neglected the point that after the video release there are at least two more releases, first on pay TV and then on free TV. Does this have an impact on t_x^* ? In the case of pay TV, this is not the case if the release happens after m_c/s_c , the point of zero of the potential-revenue-function in the cinema market. A small increase of potential revenue in the pay TV-market will then lead to an earlier release in this market, but this has no impact on the determination of t_x^* , the optimal time for the video release.

Generally, the model is applicable without modification if at any time the film is exploited in no more than two markets, meaning that there are no cinema showings after the pay TV release. This is a realistic assumption.

One difference between the cinema market and the video market on the one hand and the TV markets on the other hand is that in the former markets revenues are obtained at different times over a longer time period, whereas in the TV markets one price is paid by one buyer at one single moment. Yet this distinction is not crucial for the applicability of our model, because there are still opportunity costs

of a delay in the TV release. These opportunity costs are due to the fact that the buyer's willingness to pay is a function of the expected number of viewers.¹¹ Empirical studies indicate that the age of a theatrical movie has a negative impact on its TV rating (Taylor, 1976) or on the price paid for it, respectively (Litman, 1982).

In summary, it may be said that the model can be applied not only to video release, but to the complete sequence of market exposures. One further application is to the publishing industry, where many books have a "première" as a hardcover and are later released as a paperback. The model might help find the optimal time for the paperback release.

Returning to the optimal time for video release t_x^* , I wish to make one final point. t_x^* is optimal given the t_x of other films decided upon by other decision-makers. Yet it is possible that a concerted deviation from the respective t_x^* , a longer period of exclusiveness for all films, might be optimal. This happens if the demand (and thus the revenue) of a film does not depend solely on its own video release date, but also on the video release dates of all other films. (E.g., film A's early video release keeps people from seeing film B in the cinema). Then there exists a multilateral "prisoner's dilemma." This rationalizes the gentlemen's agreement mentioned above, which aims at a minimum delay of the video release in Germany.

Notes

1. This is one important merit of our model compared with the approach of Wildman and Siwek (1992, chapter 2), who use a different method – a numerical example – and a very different set of assumptions.
2. E.g., Variety 3.9.90, p. 101 or Variety 10.6.91, p. 3.
3. From a second-degree convex function, we obtain the same results, as is shown in Frank (1993).
4. This paper does not deal with the budget-making decision. This is done in a formal approach by Wildman and Siwek (1988, pp. 67–73).
5. If the première of a film is on video, there is usually no cinema release. Films of this type are generally of low quality, so that the publicity effect of a cinema release would be neglectable.
6. It might be of interest to see the ceteris paribus effect of a change in the speed of decrease of cinema demand on t_x^* . Ceteris paribus means here with a constant potential revenue $\int PR(t)$. It is somewhat lengthy to prove but intuitively clear that for "sleepers" the video release is later compared to other films with the same aggregated potential revenue.
7. Source: Film-Echo/Filmwoche and VideoMarkt.
8. Source: Film-Echo/Filmwoche; complete data are not available for the period considered, but there is no reason to believe that the 20 per cent is not representative.
9. The variable M is defined for the attendance of 1000 people.
10. Bundesverband Video, 1991. The growth came to a halt in 1989.
11. A theoretical approach for the explanation of prices for made-for-TV-movies can be found in Besen *et al.*, (1984, p. 95–100). Pricing of theatrical films in TV release follows a similar logic.

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