



Optimal pricing and advertising policies for an entertainment event[☆]

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ABSTRACT

The paper suggests an optimal control model to determine optimal pricing and advertising policies for a one-time entertainment event. There are two periods, an initial period of regular price sales and a terminal period of last-minute sales at a (possibly) reduced price. The price in a period is constant over time. In the initial period, the organizers of the event advertise the event to potential attendees. If tickets are sold out by the end of the first period, there will be no last-minute sales.

We find that advertising should be decreased over time during the first period. There are three different advertising scenarios: it may be optimal not to advertise at all, to advertise at a positive rate until the end of the first period, or to stop advertising at an earlier instant of time. In the last-minute sales, the organizers implement a feedback pricing policy such that the selected price depends on the number of tickets that have been sold in the regular sales period. Finally, we establish optimality conditions for the time instant where to switch to last-minute sales.

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1. Introduction

The aim of the paper is to determine optimal advertising and pricing policies for a one-time entertainment event (a classical or a rock concert, a ballet, a theater performance, a soccer match or another sports event). A basic assumption of the paper is that the organizers of the event can forecast with good precision the demand for tickets to the event, when a particular pricing and advertising strategy has been chosen. This aims to motivate our choice of a deterministic setup.

The model of ticket sales that we suggest incorporates the following features:

- (1) The supply of capacity is fixed. By capacity we mean the maximum number of tickets that can be offered for sale. Additional capacity in terms of staff, heating, refreshments, etc. are also needed, but will be disregarded here. The major part of the cost of providing and utilizing the capacity is sunk when the decision to have the event has been made. Thus, the capacity cost is independent of the number of tickets offered or sold and in what follows we disregard this cost.

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- (2) The assumption is that the event is unique. Some events may be duplicated, e.g., a concert or a ballet, and some events are organized in series. In other cases it may, however, be impossible because the performers or the location are no longer available. It is such an one-time event we have in mind here.
- (3) The organizers have the option to sell tickets for the event in two distinct markets. During a first interval of time, tickets are sold in what we call the *regular market* at a fixed price p_1 . Organizers have the option to sell tickets at a different price p_2 during a second, and terminal, interval of time. This is referred to as the *last-minute market*. Depending on the context, the last-minute price can be higher or lower than the price in the regular market. Some attendees may, in a last-minute market, be willing to pay more than the regular price. On the other hand, some theaters, for instance, offer last-minute tickets at significantly lower price than the regular price.
- (4) Since demand for tickets is deterministic, the organizers can choose pricing and advertising strategies that make sure that all tickets are sold at the regular price. This may be an optimal marketing strategy under particular circumstances and then there is no last-minute market. It may happen that such a strategy is suboptimal and the organizers then create a last-minute market in order to try to sell the remaining tickets.
- (5) Information about the event can be disseminated to potential attendees through various communication channels. One channel is communication paid for by the organizers and includes all kinds of advertisements, e.g., newspapers, radio, television, billboards, etc. Sometimes communication is free to the organizers, e.g., free media coverage in newspapers or television. Our assumption will be that all advertising is costly.

The ticket pricing policy is designed such that prices are constant over time during the respective periods. Another option would be to adopt a truly dynamic pricing policy in which prices are adjusted continuously. This is seen in practice for services like air flights and hotel rooms where suppliers adopt revenue management methods that involve dynamic pricing.

On the other hand, [Feng and Gallego \(1995\)](#) mention that full and discount prices are often prescribed. They study a setup in which these prices are fixed in advance and distinguish two cases, the markdown and the markup problem. Organizers of entertainment events do not seem to employ dynamical price adjustments. Such a policy may not be well received by customers who normally would expect that a fixed price is charged, with the exception of a last-minute price change. Thus, our setup includes intertemporal price discrimination, although the pricing scheme is a simple one.

From the point of view of a potential attendee, the issue is whether there will be a last-minute market and if so, whether she can get a ticket and at what price. From the organizers' perspective, the cost of offering the product is, by and large, independent of the number of persons attending. Therefore, any last-minute sales are additional revenues accruing at an almost zero marginal cost. For any price-discrimination policy to work, it is needed that the market is made of distinct segments having different valuations of the product. To illustrate, sellers implement various tactics to limit the number of consumers switching from the regular to the last-minute market. [Phillips \(2005\)](#) writes that 'In order to limit cannibalization, many airlines, hotels and rental car companies only offer last-minute discounts through disguised ("opaque") channels. In a similar vein, classical concerts and operas will often sell standing-room-only tickets at a deep discount once all seats have been sold' (p. 236). Our assumption in this paper will be that the organizers of the event do not advertise the last-minute price policy.

The setup is summarized as follows. The organizers of the event sell tickets at a constant regular price and advertise the event during an initial period of time. If tickets are not sold out by the end of this period, there is a last, and short, period in which tickets are offered at another constant price. In this period, no advertising is done. The organizers decide an advertising policy and the prices in the two periods. We suppose initially that the starting date of last-minute ticket sales is given. This is in line with practice in some areas of the entertainment business. For instance, in Copenhagen, many theaters sell tickets at discounted prices after 4 p.m. for performances scheduled the same day at 8 p.m. However, we also study the case where the starting time of the last-minute market is optimally determined.

Our paper is related to [Jørgensen et al. \(2006\)](#) in which we studied the problem of how information about a forthcoming event can be disseminated over time among a population of potential attendees. The objective of the organizers is to minimize advertising costs subject to ticket sales dynamics which include a word-of-mouth effect and a saturation effect. The main contribution of this paper, vis-a-vis [Jørgensen et al. \(2006\)](#) and the literature on optimal marketing decisions in diffusion models, lies in our analysis of pricing and advertising policies for an event, incorporating period-by-period constant prices and the determination of an optimal instant at which the organizers should switch from regular to last-minute sales.

Our findings are summarized as follows. Mass communication through advertising should be decreased over time as the number of tickets already sold increases. It may be optimal not to advertise, to advertise at a positive rate until the end of the regular selling season, or to stop advertising at some earlier instant of time. In the last-minute market, the organizers implement an intuitive feedback pricing policy such that price depends on the number of tickets that already have been sold in the regular market. The pricing policy in the regular market cannot, in general, be determined analytically and we propose an algorithm to find the policy. Finally, we determine optimally the instant of time where to switch from the regular market sales to last-minute market sales.

The paper proceeds as follows. Section 2 introduces an optimal control model of pricing and advertising for an entertainment event where tickets are sold in two markets. Section 3 determines an optimal pricing policy in the last-minute market and Section 4 characterizes optimal advertising and pricing policies in the regular market. In Section 5 we

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