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# Discount pricing in word-of-mouth marketing: An optimal control approach

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## Abstract

This paper addresses the discount pricing in word-of-mouth (WOM) marketing. First, a dynamic model capturing WOM spreading processes is suggested. Second, the problem of finding an optimal discount strategy boils down to an optimal control problem. Third, the existence of an optimal control for the control problem is proved, and an optimality system for finding an optimal control is presented. Thereby, the dynamic discount strategy associated with the optimal control is recommended. Some examples of the optimal control are given. Finally, the influence of different factors on the optimal expected net profit is examined.

*Keywords:* word-of-mouth marketing, discount strategy, dynamic model, optimal expected net profit, optimal control, optimality system

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## 1. Introduction

Dynamic pricing, which is defined as the dynamic adjustment of market price, has been widely adopted by marketing researchers and practitioners [1–6]; this is because price is one of the most controllable variables. In the past, dynamic pricing strategies were widely applied to traditional marketing, with a significant cost associated with changing prices [7–9]. With the advent of the Internet marketing, the overhead has greatly diminished [10–13]. Dynamic discount pricing is a common form of dynamic pricing. In contrast to a merely low price, a discounted price typically implies the high quality and unusual bargain of the item and, hence, has strong attraction to rational customers. Consequently, the design and evaluation of dynamic discount pricing strategies have long been a research hotspot in the marketing field [14–20].

As compared to traditional advertizing marketing, the emerging word-of-mouth (WOM) marketing can bring about higher marketing profit at a much lower cost [21–25]; this is especially the case with the popularity of online social networks [26]. To evaluate the performance of different WOM marketing strategies, a number of dynamic

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