Price promotion with reference price effects in supply chain

Zhibing Lin *

School of Economics & Management, Fuzhou University, Fuzhou, China

ARTICLE INFO

ABSTRACT

We consider the price promotion in a supply chain comprising one manufacturer and one retailer, who take into account the reference price effects of consumers. The problem is analyzed as a manufacturer-lead Stackelberg game. The results indicate that reference price effects could mitigate "double marginalization" effects, and improve the channel efficiency. We also show that the optimal price promotion benefits the manufacturer, retailer and consumers in consumer promotion model. Furthermore, we provide the conditions under which the retailer has an interest in offering price promotion to consumers. Finally, we employ numerical analysis to demonstrate more managerial insights.

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1. Introduction

Blattberg and Neslin (1990) delineate three types of sales promotions, namely, trade promotion from the manufacturer to the retailer, retailer promotion from the retailer to the consumers, and consumer promotion from the manufacturer to the consumers (manufacturer promotion). Traditionally, the economic literature considers consumer promotion and trade promotion to be subsidies that manufacturers offer to consumers and retailers, respectively, and it claims that under a bilateral monopoly, manufacturers and retailers achieve the same outcomes in terms of prices, quantities sold, and profits, regardless of which of the two promotion types is used (Ault et al., 2000). However, Busse et al. (2006) provide evidences from the automobile industry that the subsidy analogy does not always hold. The authors find that, the effective price paid by consumers with consumer promotion is lower than that with trade promotion.

An extensive body of literature shows that temporary price reductions substantially increase short-term sales (Blattberg et al., 1995), explaining the managers' preference for the strategy. However, the long-term effects of price promotion are usually neglected. Present literature establishes that promotional sales may have long-term effects on market demand, consumer behavior and brand franchises (Jedidi et al., 1999; Pauwels et al., 2002; Delvecchio et al., 2006). Hence, both the short- and long-term effects of promotion-related decisions should be carefully considered.

A critical issue must be addressed is that how to describe the long-term effects of promotion. In this study, we incorporate the reference price effects (Mazumdar et al., 2005) to provide insights for the long-term effects of promotion. The reference price is defined as an internal price that consumers compare with the current price to evaluate whether a current price is high or low. The firms cannot directly influence the reference price, however, their price promotion has indirect effects on future reference price. If the current price is higher/lower than the reference price, then the consumers feel losses/gains, which decreases/increases the demand in the short-term but increases/decreases the reference price in future. Therefore the firms face a trade-off between immediate gains and future benefits. In fact, many academic researches about marketing and operations management relate market demand to reference price, and focus on the effectiveness of reference price on

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* Address: No. 2 XueYuan Road, University Town of Fuzhou, Fujian Province 350116, China. Tel.: +86 059122866916; fax: +86 059122866410.
E-mail addresses: linzhibing@gmail.com, linzhib@fzu.edu.cn

dynamic pricing (Fibich et al., 2003; Popescu and Wu, 2007), inventory decision (Urban, 2008; Güler et al., 2014, 2015; Dye and Yang, 2015), and advertising (Zhang et al., 2013; Lo et al., 2013). However, literature about price promotion with reference price effects is scant. Furthermore, existing studies usually focus on retailer promotion and ignore the important interaction between the manufacturer and the retailer (Greenleaf, 1995; Darke and Chung, 2005; Fibich et al., 2007; Coulter and Krishnamoorthy, 2014).

In this study, we develop a Stackelberg game in a bilateral monopoly supply chain with reference price effects of consumers. Our objective is to provide a better understanding of price promotion. In particular, we plan to answer the following questions:

(1) How does consumer promotion affect the performance of supply chain members while consumers show reference price effects?
(2) Should the retailer participate when the manufacturer offers consumer promotion?
(3) How do reference price factor and consumer loyalty[1] affect the decision variable and the performance of supply chain members?
(4) Will the reference price effects mitigate "double marginalization" effects[2]?

We consider three models to address these questions. The first is the benchmark model (BM), in which the supply chain functions as an integrated channel and the price promotion is offered to maximize the channel profit. The second is the consumer promotion model (CPM), in which the manufacturer offers consumer promotion to maximize his profit, while the retailer does not involve in the promotion program. The third is the consumer and retailer promotion model (CRPM), in which the manufacturer acts as the Stackelberg leader and decides on the depth of consumer promotion, the retailer acts as the follower and decides on the depth of retailer promotion.

In practice, the price promotion is commonly adopted in industries such as consumer electronics, computer software and home appliances (Demirag et al., 2011). And this study will generate some interesting results with precious insights, which will not only help supply chain members understand more about the price promotion program, but also help practitioners and researchers know how to improve the channel efficiency. This will be especially meaningful to industries such as automobile and airline, in which the production capacity and published price seldom change, and price promotion is usually used to achieve higher profits (Demirag et al., 2010).

The rest of this paper is organized as follows. Section 2 provides a brief review of related literature. Section 3 describes the assumptions and notations. Section 4 discusses the optimal price promotion in the integrated channel. Section 5 discusses the optimal price promotion in the decentralized channel. Section 6 compares optimal price promotion and the profits of different models. Section 7 conducts a numerical analysis to investigate the impacts of memory factor, reference price factor and direct price sensitive factor on the equilibrium outcomes. Section 8 discusses the impacts of positive price promotion assumption. Conclusion remarks are given in Section 9.

2. Literature review

There are two research streams related to this paper: sales promotions and reference price effects. We briefly review the relevant literature in this section.

Since the early 1970s, sales promotions have emerged as an important part of the marketing strategies, and many peculiarities have been shown. Keng and Ehrenberg (1984) show that frequent price promotions by retailers induce low store loyalty among consumers of grocery products. Walters (1991) also offers evidences of consumers cross shopping between competing stores to take advantage of price promotions for one brand as well as its substitutable brands. Srinivasan et al. (2004) show that the retailer promotion typically increases category revenue, but decreases category margin. Sigué (2008) uses two 2-period models to investigate the effects of price promotion strategies on channel decisions and profits, and indicates that retailers prefer retailer promotion, while manufacturers may find it optimal to not invest in consumer promotion. Martín-Herrán et al. (2010) compare trade deals with instant rebates, and find that choosing between these two types of price promotion critically depends on consumer sensitivity to regular price and promotional depth. Martín-Herrán and Sigué (2011) examine the optimality of both exogenous and endogenous wholesale pricing approaches during instant price promotion and find that manufacturers should only offer rebates when they keep their prior-to-promotion wholesale prices unchanged. Tsao and Sheen (2012) study a two-echelon multiple-retailer distribution channel under retailers' promotional efforts and the sales learning curve, and show that keeping the fraction of promotion cost sharing within an appropriate range increases profits for all parties under channel coordination. Saha (2013) proposes three different rebate and effort induced contracts, and examines coordination of the supply chain when these coordination

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[1] Briesch et al. (1997) use scanner data to compare five reference price models, and show that the best model in terms of fit and predictions is the memory-based one. In the memory-based model, the reference price is a weighted average of past prices, and the weight is characterized by the consumers' memory. Since memory is an indicator of shopping frequency, Popescu and Wu (2007) consider it as a proxy for customer loyalty.

[2] It is well known that, if both manufacturer and retailer maximize their own profits, double marginalization, a phenomenon first identified by Spengler (1950), will prevail. We can be more specific: both manufacturer and retailer will make decisions on promotion which end up with a smaller promotion depth than that in the integrated channel.