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Efficient replenishment in the distribution channel

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Abstract

Efficient replenishment (ER), a business process that involves the reduction of order cost to facilitate deliveries of goods from the manufacturer to the retailer, is becoming increasingly important in distribution channel management. While a well-executed ER program is expected to lower total channel costs and increase channel profit, very little is known about how this incremental channel profit is distributed between the manufacturer and the retailer and how it varies across the two common channel relationship structures, retailer price leadership and manufacturer price leadership.

In this paper, we develop the conditions under which the manufacturer and the retailer gain more or less from the adoption of ER based on a game theoretic channel model of bilateral monopoly under the two channel relationship structures. We develop analytic results on the impact of ER on purchase quantity, price and the distribution of profits in three cases, namely, (1) when only the retailer adopts ER, (2) when both the manufacturer and the retailer adopt ER, and (3) when the manufacturer and the retailer are vertically integrated in the distribution channel, which adopts ER.

The results, which can be generalized for all demand functions, show that the manufacturer benefits from the retailer's adoption of ER only when the manufacturer's holding cost relative to the retailer's is sufficiently large, relative to its order cost relative to the retailer's. By adopting ER, the retailer gains more than what the manufacturer gains even if the manufacturer is the price leader. Both the parties are likely to gain more if they both adopt ER than if only the retailer adopts ER. The incremental channel profit due to the retailer's ER adoption is highest in a vertically integrated distribution channel and is greater in a retailer-led channel relationship than in a manufacturer-led relationship.

Keywords: Retailer–manufacturer relationship; Channel management; Efficient consumer response (ECR); Efficient replenishment; Game theory

Introduction

Efficient consumer response (ECR) has become an increasingly important business practice for manufacturers and retailers to attain competitive advantage in the distribution channel (Levy and Grewal 2000). Efficient replenishment (ER) is a program within ECR that has gained widespread attention among manufacturers and retailers. ER can be defined as a business process that involves the reduction of order cost to facilitate of goods from the manufacturer to the retailer in the channel (McKinney and Clark 1995). ER can be undertaken by either the retailer or the manufacturer or both, but its impact extends to the whole channel. The order cost reduction in ER comes from benefits such as negotiation simplification, paper work reduction, order lead time reduction, faster manufacturer/retailer evaluation and selection, automated manufacturer/retailer rating systems, and speedier quality assurance. This view of ER is consistent with that in the consulting industry (e.g., IBM Report 1999; Sykes Enterprises 1999).

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Anecdotal evidence suggests that the adoption of ER is associated with industry cost savings and firm performance. It is estimated that the annual savings due to ER are about $11.9 billion in the food industry (Supermarket Business 1998) and about $11 billion in the healthcare industry (Transportation and Distribution 1997). With regard to firm performance, a firm like CVS pharmacy has managed to reduce its backroom inventory to 10–15 percent of total inventory through ER (Chain Store Age 2001). Furthermore, in a survey of business executives, Myers et al. (2000) found that the use of automatic replenishment service programs was positively related to firm performance.

Although anecdotal evidence indicates that channel profit may rise as a result of ER, the incremental channel profit may be unequally distributed between the manufacturer and the retailer depending on the relationship structure, that is, whether the channel price leader is the retailer or the manufacturer, and on other factors. It is important for managers to know which party gains more and what conditions are associated with such gains. By better understanding the allocation of incremental channel profit between the manufacturer and the retailer due to ER and channel relationship structure, managers can make more informed pricing, inventory holding, and ordering decisions.

From a theoretical standpoint, researchers need to better understand when and why the manufacturer's or the retailer's profit rises due to ER adoption by one or more channel members. The unequal distribution across the manufacturer and the retailer of the additional profit due to ER adoption may depend on several factors such the channel relationship structure (who is the price leader? the manufacturer or the retailer?), the entity adopting ER (the retailer or both), the cost function (e.g., linear, nonlinear), the demand function (e.g., linear, nonlinear), and the relationship among the holding and order costs of the manufacturer and the retailer. There is an important need for a theoretical model that would address these issues.

Despite the need for a theoretical model of ER adoption, there has been little research on ER among marketing or operations management academics. Marketing academics have predominantly focused on channel coordination pricing (e.g., Choi 1991; Ingene and Parry 1995, 2000; Jeuland and Shugan 1983; McGuire and Staelin 1983), or discount policy (e.g., Lal and Staelin 1984), but not on ER. Scholars in operations research and supply chain management have focused on either Just-in-Time (JIT) programs or inventory policy in the channel (e.g., Weng 1995), or Quick Response (QR) initiative (e.g., Iyer and Bergen 1997), but have not examined the impact of ER. While JIT is aimed at minimizing inventory and QR is focused on reducing order lead time, ER is about reducing order cost. In addition to pricing decisions, ordering decisions are important in the marketing channel (Hall et al. 2005). The purpose of this paper is to extend prior research by developing a game theoretic model of the impact of ER on channel outcomes for both the manufacturer and the retailer.

We consider a bilateral channel monopoly with two alternative channel relationship structures: (a) a dominant retailer acting as a Stackelberg price leader, and (b) a dominant manufacturer acting as a Stackelberg price leader. We derive analytic results on the impact of ER adoption in three cases: (1) when only the retailer adopts ER, (2) when both the manufacturer and retailer adopt ER, and (3) when the manufacturer and the retailer are vertically integrated and jointly implement ER.

Our research is distinct from Weng (1995) and Choi (1991) and offers important contributions over their work. Although our modeling framework is consistent with Weng (1995), unlike Weng who focuses on quantity discounts and cooperative behavior, we focus on ER and examine Stackelberg leadership by both the manufacturer and the retailer. Similar to Choi (1991), we develop two models representing different retailer–manufacturer price relationship structures, retailer-led and manufacturer-led Stackelberg models.[1] However, while Choi examines the effects of production cost on the equilibrium price and profit levels in a two product situation, we include inventory costs in our model and examine the effects of a reduction in the order cost (or ER) on the equilibrium quantity, price, and profit levels of the manufacturer and the retailer for a single product scenario. To our knowledge, our work is the first to model the impact of ER on channel outcomes in different channel relationship structures, offering important insights into the role of ER in the distribution channel.

Our analysis offers important and counter-intuitive insights that can be generalized for all demand functions. The results show that the manufacturer will benefit from the retailer's ER adoption only when the manufacturer's holding cost relative to the retailer's is sufficiently higher than its order cost relative to the retailer's. By adopting ER, the retailer gains more than what the manufacturer gains even if the manufacturer is the price leader. Both the retailer and manufacturer will gain more if they both adopt ER than if only the retailer adopts ER. The incremental channel profit due to the retailer's ER adoption is highest in a vertically integrated distribution channel and is greater in a retailer-led channel relationship than in a manufacturer-led relationship.

[1] By Stackelberg leadership, we refer to the leader (manufacturer or retailer) first making a decision on price, followed by the follower (retailer or manufacturer) making a decision on quantity, consistent with Wang and Seidmann (1995). We do not focus on Nash equilibrium between the manufacturer and the retailer because it can be shown that the results for such a game structure fall in between the two interesting extremes of results from the two Stackelberg leadership structures.