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# Competition among supply chains: Implications of full returns policy

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ABSTRACT

We examine decisions of retailers and manufacturers in two competing supply chains selling a substitutable product, with demand uncertainty, when manufacturers offer or do not offer full returns policies. We consider retailers' two pricing strategies, optimal pricing and clearance pricing, and we find that full returns policies have different implications in the presence of chain-to-chain competition as compared to the case of a monopoly supply chain. The conditions under which manufacturers and retailers prefer or not prefer full returns policies are identified.



## 1. Introduction

The means by which manufacturers share the responsibility and risk of unsold inventory with retailers is one of the critical issues in supply chain management. It is a common practice for manufacturers to offer some type of returns policy to encourage retailers to order more products when they sell products with short life cycles and demand is uncertain. The extreme cases are the cases in which the manufacturer takes all responsibility by buying back all unsold inventory with a full-returns policy, or the retailer takes all responsibility and the manufacturer has a no-returns policy.

Traditional research on returns policies has identified the role of returns policies and has considered returns policies as a means of encouraging retailers to order more products. Kahn (1992) provided examples from various industries. The book, magazine, newspaper, video product, jewelry, and dairy product industries accept returns, while the fashion apparel, flower, greeting card, computer software, and toy industries do not. Returns policies also vary by distributor. For example, book and video clubs have no-returns policies while book and video retail-stores usually adopt returns policies; regular fashion apparel stores have no-returns policies, while the high-end fashion apparel stores implement returns policies.

Returns policies have been extensively studied in the literature (e.g., Lau and Lau, 1999; Lee, 2001; Tsay, 2001, 2002). Marvel and Peck (1995) argued that a returns policy could mitigate the demand uncertainty for the retailer. Other research, however, found that the role of a returns policy was more than simply taking the responsibility of the risk of excess inventory. Pasternack (1985) examined the returns problem in which a manufacturer provides a seasonal product under the newsvendor framework. He investigated the methods of channel coordination through a buy-back policy and showed that there exist pairs of wholesale price and buyback price that can achieve channel coordination, and that different pairs of wholesale price and buyback price result in different ways of splitting the chain's profit between the manufacturer and the retailer. Kandel (1996) identified six major factors resulting in the implementation of a returns policy. Mollenkopf et al. (2007) used an empirical study to explore how internet product returns management systems affect loyalty intentions. Chen and Bell (2011) proposed an agreement between the manufacturer and the retailer that includes two buyback prices, one for unsold inventory and a second for customer returns to achieve supply chain coordination when the retailer is experiencing customer returns and price dependent stochastic demand. Chen (2011) proposed a returns policy with a wholesale-price-discount scheme (returns-discount contract) that can achieve supply chain coordination. Ding and Chen (2008) studied a flexible returns policy in a three-echelon supply chain and showed that an appropriate returns policy could achieve supply chain coordination and profit reallocation in the supply chain. Yue and Raghunathan (2007) examined the impacts of a full-returns policy on a supply chain with information asymmetry between the manufacturer and the retailer, and identified the conditions under which not only the

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retailer but also the manufacturer benefits from the policy. Matsui (2010) examined how economic outcomes differ for the introduction of a new product model under two extreme contracts: no-returns policy and a full-returns policy. He found that with no returns, the retailer's incentive to introduce a new model can lead to a reduction of consumer welfare when the retailer is moderately risk averse. A full-returns policy resolves this conflict between firms and consumers. Brown et al. (2008) considered a multi-item (pooled) returns policy, under which the retailer can return any combination of the products up to a certain percent of the total purchases across all products. They showed that the retailer always achieves a higher profit, while the manufacturer could actually experience lower profit under the pooled policy.

Emmons and Gilbert (1998) analyzed the impact of a returns policy on a supply chain that consists of a manufacturer and a retailer, when demand is price-dependent and stochastic. They found that when the wholesale price is set in a certain range, both the manufacturer and the retailer gain more profits through a returns policy, in comparison to the case of no returns. Granot and Yin (2005) introduced a returns policy to a newsvendor problem with price-sensitive demand. They found that under certain circumstances, the manufacturer does not benefit from offering a returns policy. Under some circumstances, however, the introduction of a returns policy led to a profit shift from the retailer to the manufacturer, and therefore increased both the wholesale price and the retail price.

In the present paper, we investigate the impact of full returns policies for two competing chains facing demand uncertainty, and find that both manufacturers and retailers do not always benefit from full returns policies. This motivates us to identify the conditions under which both manufacturers and retailers prefer returns policies, and under which both manufacturers and retailers prefer no-returns policies.

A returns policy also results in competition in a supply chain. Padmanabhan and Png (1997) argued that a returns policy could avoid quantity competition, but would intensify the price competition among retailers. Wang (2004) modified this conclusion and pointed out that a returns policy did not intensify the competition among retailers in a deterministic environment. All these papers on returns policies focused on a single supply chain with or without competition among the players. In business practice, however, competition exists among supply chains, manufacturers, and retailers in many industries. In the presence of chain-to-chain competition, it is interesting to investigate the impact of a returns policy on the profits of manufacturers and retailers, when a returns policy should be implemented, and whether or not a returns policy intensifies the competition among manufacturers or retailers. In this paper, we develop models for two competing supply chains and find that under some circumstances, full returns policies intensify price competition between retailers while weakening price competition among manufacturers.

The concept of chain-to-chain competition was first proposed in marketing research. McGuire and Staelin (1983) investigated a vertical structure with two manufacturers and two exclusive retailers. With a deterministic linear demand function, they found that a decentralized distribution system strategically avoided the price competition among manufacturers. Moorthy (1988) linked the interaction between a decentralized channel structure and a downstream vertical integration structure. Atkins and Zhao (2003) internalized the degree of competition and examined equilibrium structures for price and service competition in a supply chain. Wu and Chen (2003) proposed a chain-to-chain competition model and analyzed the equilibrium structures for competing supply chains considering inventory and returns policies in a newsvendor setting. Anderson and Bao (2010) considered price competition with a linear demand function for competing chains. By comparing a centralized supply chain to a decentralized supply chain, they demonstrated the important role played by the spread of underlying market shares. The coefficient of variation of these market shares determines whether decentralized supply chains can outperform centralized supply chains with an appropriate level of competition. Wu et al. (2009) investigated the equilibrium behavior of two competing supply chains in the presence of demand uncertainty. They considered three possible supply chain structures: vertical integration, manufacturer's Stackelberg, and bargaining on the wholesale price. None of these papers, however, linked retailers' pricing decisions to the implementation of full returns policies. In the presence of chain-to-chain competition and under manufacturer's Stackelberg, we examine the impact of full returns policies on retailer's two pricing strategies: optimal pricing and clearance pricing. We find that whether a pricing strategy without a full-returns policy is more advantageous than the case with a full-returns policy depends on the degree of product substitution and the level of demand uncertainty. Competition among supply chains prevails in many industries, where decisions by each party are quite different from those made in a monopoly supply chain setting.

The contributions of this paper are: we first examine the implementation of full returns policies in the presence of chain-to-chain competition and show the behavior and decisions of each party as compared to those in a monopoly supply chain; we also determine the conditions under which both manufacturers and retailers prefer or not prefer a full-returns policy.

The rest of the paper is organized as follows. We introduce our research setting in Section 2 and discuss retailers' optimal strategies when manufacturers do not offer a full-returns policy in Section 3. We address the equilibrium solution under which manufacturers offer a full-returns policy in Section 4, while discussing issues of implementing a full-returns policy in Section 5. We present the conditions under which both manufacturers and retailers prefer no-returns policy in the Section 6 and conclude in the last section. All proofs are given in the Appendix.

## 2. Research setting

In this paper, we develop models for two competing supply chains selling substitutable products. Each supply chain consists of a manufacturer who supplies a product to its own retailer. The two supply chains are symmetric which could be the case that two supply chains are competitive, for example in the size of supply chain. Manufacturers must decide wholesale prices, and also whether or not to offer full returns policies for any quantity of unsold items, with a refund of the wholesale price per unit. Retailers should decide stock levels. After observing the demand level, retailers should decide retail price, adopting either an optimal pricing strategy or a clearance pricing strategy. The notations are presented in Table 1.

We now define the decision-making process: in stage 1, manufacturers choose wholesale prices ($w_i$, $i=1,2$) and announce whether or not they offer a full-returns policy to their retailers; in stage 2, retailers set inventory stock levels based on expected demand; in stage 3, after observing the actual demand, retailers set retail prices given the available inventory stock levels. The decision process reflects that manufacturers are Stackelberg leaders in the two supply chains. Manufacturer Stackelberg supply chain are fairly common in practice, as when relatively large manufacturers supply products to relatively small retailers.

For a supply chain consisting of a manufacturer and a retailer, Padmanabhan and Png (1997) conclude that when there is sufficient difference between high and low demand, the retailer will find it optimal to order a stocking level such that he will stock out