Chapter 10

Supply Chain Coordination under Price Competition

S.P. Sarmah
Indian Institute of Technology, India

Santanu Sinha
Indian Institute of Technology, India

ABSTRACT

This chapter analyzes the coordination and competition issues in a two-stage supply-chain in which a vendor distributes a product to two different retailers who compete on their retail prices in the same market. The demand faced by each retailer not only depends on its own price, but also on the price set by the other retailer. Mathematical models have been developed to analyze the coordination mechanism. It is shown here that perfect channel coordination can be achieved by employing simultaneously quantity discounts, volume discounts and franchise fees. Further, it has been shown that under non-cooperative price competition, the steady state equilibrium is dynamically stable in nature under certain conditions. The model is illustrated with suitable numerical examples.

INTRODUCTION

In the recent years, significant changes have taken place in the business environment. Among the many factors, globalization of business, proliferation of electronic marketplace (e-market), increased market competition, awareness of customers, and increased demand for the value added products/services have largely contributed to the change in the shift. The changing business scenario has compelled academic researchers and industry leaders to re-think about how to manage business operations more efficiently and effectively. Since, scope for improvement within an organization is restricted with limited resources; they are looking for newer alternatives. One of the most popular and effective alternative for the same is to integrate the business activities beyond the individual organization's boundary. In this context, several strategies have been discussed in the literature to integrate the business processes and activities of the

members in a decentralized supply chain to ensure system-wide performance improvement in terms of cost, timely delivery of the products and customer service. The system-wide performance improvement in literature is referred to as supply chain (channel) coordination and is concerned with the development and implementation of different coordination strategies to obtain global optima rather than local optima which often causes sub-optimal performance of a supply chain.

A significant amount of literature has addressed different aspects of supply chain coordination issues through different mechanisms. Within the large spectrum of existing literature in this area, centralized and decentralized models can be considered as two extremes. A centralized solution achieves the global optima, while the performance of the decentralized models is mostly found to be sub-optimal. Therefore, the aim of a coordination mechanism is to enhance the efficiency of the decentralized channels up to the global optimal. Among the several coordination mechanisms developed in the existing literature, price/quantity discount policy is an effective and popular mechanism. From an operational perspective, researchers focus on coordination mechanisms that can align the objectives of individual supply chain members. A considerable number of research articles are available in the literature that has studied the effect of discount policy to coordinate the supply channels. Excellent reviews have been provided by Goyal and Gupta (1989), Benton and Park (1996), and recently Sarmah et al. (2006).

A single vendor and single buyer together constitute a simple two stage supply chain and this forms the basic building block for the study of any complex supply chain. From the perspective of B2B, within the scope of a two stage supply chain, a vendor may be either a wholesaler/distributor who receives the supply from an external source of supply or a manufacturer who produces the items in-house. Similarly, a buyer is a retailer who sells the products to the end consumers in the market. Further, changing needs and varied utility of consumers have given rise to wide range of products with diverse degree of substitutability. With the diversification of product types, competition among the vendors has increased. As a result, in a typical two-stage production and distribution channel, if there are many retailers in the market who can supply similar type of products to the end consumers, there arises price competition among the retailers and under such circumstances, development of coordination mechanism is an important area of study. The chapter deals with the coordination and competition issues in a two-stage supply chain where a vendor distributes a product to two different retailers. The retailers add some value to the product and compete on their retail prices to sell it in the same market. Demand generates only at the retailer's level and each retailer replenishes its inventory from the supplier. The final products are substitutable to each other and the demand faced by each retailer not only depends on its own price, but also on the price of the other retailer(s). There are many examples of substitutable products in different market place, such as, Pepsi and Coca-Cola in soft drink market, Sotheby's and Christie's in diamond auctions, Kodak and Fuji-film in motion picture film market, etc. In the consumer goods market, most of these specific products/brands are sold through specific retailers; e.g., consumer electronics, sporting goods and automobile parts etc.

Here, we have extended the profit maximization economic order quantity (EOQ) model to the case of both centralized and decentralized settings. In the case of a centralized system, the derived solution is globally optimal and has been taken as a benchmark solution for comparison with the decentralized system. The decentralized system has been studied under two different situations namely, (i) competition without coordination, and (ii) competition with coordination. The first case is studied as a Stackelberg game where the vendor acts as a leader, selects an optimal per-unit wholesale price for the product. In the next stage, based on the per-unit wholesale price decided by the vendor, both the retailers as follower choose their optimal retail prices and replenishment strategies simultaneously under Bertrand price com-

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