

Vertical cost information sharing in a supply chain with value-adding retailers[☆]

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Received 12 August 2005; accepted 19 April 2006

Available online 9 June 2006

Abstract

We consider a supply chain consisting of one supplier and two value-adding heterogeneous retailers. Each retailer has full knowledge about his own value-added cost structure that is unknown to the supplier and the other retailer. Assuming there is no horizontal information sharing between two retailers, we model the supply chain with a three-stage game-theoretic framework. In the first stage each retailer decides if he is willing to vertically disclose his private cost information to the supplier. In the second stage, given the information he has about the retailers, the supplier announces the wholesale price to the retailers. In response to the wholesale price, in the third stage, the retailers optimize their own retail prices and the values added to the product, respectively. Under certain conditions, we prove the existence of equilibrium prices and added values. Furthermore, we obtain the condition under which both retailers are unwilling to vertically share their private information with the supplier, as well as the conditions under which both retailers have incentives to reveal their cost information to the supplier, thus leading to a win–win situation for the whole supply chain.

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Keywords: Value-added; Supply chain; Information sharing; Distribution channel; Game theory

1. Introduction

The concept of “value-added”, the idea of adding service or components to a product to increase its value or price [1], has been a buzzword in recent years. In order not to be disintermediated in this competitive E-business era, each stage in a supply chain needs to add appropriate value to a product. There are numerous ways to add value to a product. A retailer can bundle the product with value-added service/delivery or provide desirable value-added packaging [2]. In the IT industry, value can be added through services, free software, technical training or maintenance. For example, software companies (e.g., Systemax) may bundle the PC with a package of free internet access such as basic AOL service [3]. In hi-tech industries (e.g., electronics industry), value can be added through simple components labeling and kitting to complex supply chain management service [4].

[☆] This manuscript was processed by Associated Editor Richard Metters.

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Since there are always operating costs incurred related to corresponding value-added service, one natural research question arises: how much value should be added, especially under a competitive market structure? In this paper, we will examine a distribution channel in a supply chain made up of one supplier and two heterogeneous value-adding retailers/distributors. Both retailers order generic products from a supplier, and add certain value to the product, then sell the product to customers. We are interested in studying how much appropriate value should be added to the generic product by each retailer.

Many business practices around such types of distribution channels can be found in real life. For example, IT solution providers may order white box PCs from suppliers, then add appropriate value (e.g. offer antivirus software, technical training, provide extended warranty). Actually, CRN research showed that white boxes are their best-selling desktops, compared to branded name PCs [5]. In the electronics industry, distributors may offer value-added services such as connector and cable assemblies, customized integration, supply chain management services such as a vendor managed inventory (VMI) program, or even design service [6]. In the franchising industry, each franchisee acquires the franchisor's generic product (the rights to use franchisor's names, trademarks, etc.), then adds value and sells to the customers [7]. In the retailing industry, retailers may add value to electronic products by providing an extended warranty or offering lenient returns policy. For example, Best Buy's warranty policy would cover defects the manufacturer does not cover, while Wal-Mart's warranty policy begins after the manufacturer's policy expires [8].

Researchers have examined distribution channels with one player working with two other players. For example, Choi [9] studied price competition in a distribution channel with two suppliers and one retailer. Under a different market structure, he analytically obtained channel decisions for three non-cooperative games between the manufacturers and the retailer. Tsay and Agrawal [10] investigated a supply chain with one supplier supplying a common product to two retailers, and both retailers competing with each other along both price and service policies. Tsay and Agrawal examined each party's pricing strategy, total sales, market share and profitability.

However, existing studies of distribution channels assume supplier and retailers compete with complete information. In other words, the research assumes that information such as production cost, operating cost and other market parameters about supplier or retailers are common knowledge to all parties in a supply chain. This assumption may not hold in real life. In practice, each party in a supply chain usually possesses private information that is unknown to outsiders, and these firms are likely to protect their sales strategies by hiding their private cost or demand information [11], thus leading to a competition under incomplete information. For example, warranty cost is confidential information for retailers such as Best Buy and Circuit City because significant portions of their operating profits are from the warranty service [8]. Franchisees also hold their private cost information of sale and decide if they will reveal their cost information to the franchisor in the contract [7]. Therefore, what information to share and how to share information becomes an interesting research issue.

Some researchers have studied information (e.g., demand, cost, and inventory) sharing/asymmetry in a supply chain. For example, Li [12] studied the incentives a firm would need to share its private information (demand and costs) with its competitors; Gavirneni [13] analyzed a supply chain where inventory information is shared between the supplier and retailer. Cachon and Fisher [14] investigated the sharing of demand and inventory data in a supply chain with one supplier and multiple identical retailers. Agrell et al. [15] examined information sharing in telecom supply chains where a supplier has private cost information and investment opportunities. Corbett et al. [16] analyzed a supply chain with one supplier and one buyer, and studied the value to the supplier of offering more general contracts and acquiring more accurate information about the buyer's cost structure. Assuming that information asymmetry between a manufacturer and a retailer, i.e., the retailer's knowledge of the manufacturer's cost is incomplete, Lau et al. [17] also studied how to set up the wholesale price and retail price in a supply chain.

In this paper, we will examine a supply chain consisting of one supplier and two heterogeneous retailers. There is horizontal competition between the two retailers, each of whom orders common generic products from the supplier, adds value to the products, then sells to customers. In addition, the supplier has no complete knowledge of the retailers' cost structure regarding value-added information. Each retailer needs to decide if he is willing to vertically share his cost information with the supplier.

Previously, Li [18] and Zhang [19] studied a vertical information exchange in a supply chain where demand information is uncertain to the supplier. Their focus was on the effects of horizontal information leakage for vertical information sharing in a supply chain, i.e., if one retailer vertically discloses his information to the supplier, the latter will react to the revealed information, and make decisions accordingly. Li and Zhang discovered that the other retailer can infer his competitor's private information through the supplier's decision.

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