SUPPLY CHAIN COORDINATION USING REVENUE-SHARING CONTRACT WITH DISTRIBUTOR’S EFFORT DEPENDENT DEMAND

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Abstract
Revenue-sharing contracts are a kind of mechanism aimed at improving performance and achieving precise coordination of the supply chain. In this paper, we analyse and develop the revenue-sharing contract model of the three-level supply chain with distributor’s sales effort dependent demand. The paper discusses the impacts of sales efforts on coordination of the supply chain and explains the reasons why traditional revenue-sharing contracts cannot coordinate the supply chain in this condition. In order to coordinate the supply chain, supposing the distributor bears the sales effort costs, the paper proposes an improved revenue-sharing contract based on a quantity discount policy. Three conditions are taken into consideration: the improved contract is only implemented between the retailer and the distributor, only implemented between the distributor and the manufacturer, and implemented both between the retailer and the distributor and between the distributor and the manufacturer. The paper shows that the improved revenue-sharing contract can coordinate the supply chain by carrying it out in one transaction or two transactions of the three-level supply chain. By supposing the effort and the market demand satisfy the multiplication form, we characterize the optimal decision variables (sales effort and inventory quantity). At the end, a numerical example is given to demonstrate the correctness of this paper.

Key Words: Supply Chain Coordination, Revenue-Sharing Contract, Effort, Quantity Discount

1. INTRODUCTION

With increasingly intense market competition, companies have realized that setting up a supply chain with other companies is an effective way to improve their core competitiveness. Usually, these various companies have independent decision-making power (decentralized decision-making). When supply chain members try to optimize their own profits, the whole profit of the supply chain will inevitably be affected, which is the so-called “double marginalization”. To deal with this problem, supply chain contracts are designed to facilitate interaction between the disparate supply chain members and to motivate participants to behave in the best interests of the supply chain (maximization of total supply chain profit). By specifying contract parameters such as order quantity, the supply chain contracts can provide protection for supply chain members against self-seeking behaviour [1]. Many contracts, including the wholesale price contract, the buy back contract, the revenue-sharing contract, the quantity flexibility contract and the option contract, have been applied to coordinate the supply chain.

The revenue-sharing contract [2], in which retailers pay royalties on product sales to suppliers, has been widely applied in supply chains, particularly in the video rental and movie industries. The contract can be described by two parameters \((w, \phi)\): the supplier charges the retailers a unit wholesale price \(w\), lower than the unit marginal cost \(c\), in exchange for \((1 - \phi)\) percentage of the retailer’s revenue. The condition \(w < c\) guarantees channel coordination whereas \(\phi\) determines the distribution of total profits between the supplier and the retailer. In particular \(\phi\) is the supply chain profit quota gained by the retailer. In recent years, supply


