Reverse and closed loop supply chain coordination by considering government role

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ABSTRACT

Due to the increasing number of end-of-life (EOL) products and their related environmental concerns, much attention has been paid to reverse logistics. In this paper, we consider a two-echelon reverse supply chain (RSC) with one manufacturer and one retailer who try to improve sustainable consumption by increasing customers’ willingness to return used products through offering a discount or a direct fee in exchange for bringing back EOL products. Afterward, the model is extended to consider a closed loop supply chain (CLSC). Quantity discounts and increasing fee contracts are proposed to coordinate supply chains. Then, government role in improving coordinated supply chains through donating different incentives (tax exemption and subsidy) to supply chain members are analyzed. Results show that total channel profit in the coordinated case is improved. Also, in the proposed models, each member has enough motives to participate in the plan. In addition, results demonstrate that government-sponsored incentives to the manufacturer are preferred to the retailer.

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1. Introduction

Over the last two decades, many companies and industries in developed countries have begun considering reverse logistics (RL) as one of the important processes in their supply chain. In the academic world, according to the special features of this backward process and its differences with forward operations, researchers have also paid special attention to it. According to Gupta (2013), there are several environmental and economic concerns that pertain to RL operations, including saturated landfill areas, global warming, rapid depletion of raw materials, increasing amount of customer returns, and a rise in the volume of internet marketing. The establishment of both RSC and CLSC systems becomes a critical requirement of societies in both developed and developing countries (Govindan et al., 2015; Govindan and Soleimani, 2016) but the issue is highly complex and challenging (Vahdani et al., 2013; Wang et al., 2016). The successful performance of a reverse logistics system depends on EOL products and customers’ willingness to return their obsolete products to complete the cycle (Shaharudin et al., 2015). Level of customers’ willingness to return can be mapped to a real positive number in the interval...
Section 7 draws conclusions and further research directions. Analyses. Section 5 compares various scenarios of government intervention. Section 6 provides managerial insights and, finally, discusses in Section 5. Specific differences between tax exemption and subsidy in the proposed models will be discussed.

Tax exemption may result in less payment for the consumers and, hence, a broader segment of society will benefit from this mechanism. In such cases, government has to use subsidy rather than tax exemption. However, from society’s viewpoint, the plan is extended to consider both forward and reverse operations as a closed-loop SC where remanufactured products are taken back until they again meet the demand. Since large amounts of reverse operations may not be economically justified, the effects of government interventions are modeled in four different scenarios: (1) Tax exemption donated to the manufacturer, (2) Tax exemption donated to the retailer, (3) Subsidy donated to the manufacturer, and (4) Subsidy donated to the retailer. In this regard, this study applies two different types of government interventions: subsidy and tax exemption. These two intervention types are different from various aspects and each one can be used under specific conditions. From the viewpoint that considers ease of implementation, donating subsidy logically seems to be an easier method than a tax exemption. In addition, if tax exemption amount is not adequate for the retailer’s or the manufacturer’s incurred cost, then applying a tax exemption cannot convince them to participate in the plan. In such cases, government has to use subsidy rather than tax exemption. However, from society’s viewpoint, tax exemption may result in less payment for the consumers and, hence, a broader segment of society will benefit from this mechanism. Specific differences between tax exemption and subsidy in the proposed models will be discussed in Section 5.

The remainder of current study is organized as follows. In Section 2 we present a literature review on coordination contracts and government roles in reverse supply chains, followed by analytical models and supply chain profit functions for both reverse and closed-loop SC models provided in Section 3. Section 4 provides a numerical example and sensitivity analyses. Section 5 compares various scenarios of government intervention. Section 6 provides managerial insights and, finally, Section 7 draws conclusions and further research directions.
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