Acquisition pricing and remanufacturing decisions in a closed-loop supply chain

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Abstract

This paper models a closed-loop supply chain (CLSC) with a manufacturer and its supply channels - recycle channel and reliable supply channel. We assume that the manufacturer may reuse the recycled main product component and remanufacture the product. The recycle channel shows stochastic recovery rate. Both the centralized(integrated) recycle channel CLSC and the decentralized recycle channel CLSC are studied. The optimal production decision and the optimal acquisition pricing decision are obtained for both the deterministic demand and the stochastic demand cases. Further, the paper discusses the supply chain inefficiency in this CLSC. It is shown that under decentralized recycle channel structure, the optimal acquisition price is always lower than the optimal acquisition price under centralized recycle channel structure, causing reduced recycle quantity and lower remanufactured quantity, which is similar to the effect of double marginalization in the normal forward supply chain. The cost difference between the two supply channels also increases such double marginalization impact. In order to reduce such supply chain inefficiency, two contracts (complete compensation and partial compensation) are proposed. It is shown that under certain conditions, both contracts are Pareto improving for the decentralized supply chain and can be used to coordinate the CLSC. Numerical examples are used to illustrate the results. The numerical examples show the different preferences of supply chain parties on different risk reductions in the decentralized system. In general, the interests on demand risk reduction is aligned between the recycle channel supplier and the manufacturer with the manufacturer showing higher motivation; on the other hand, recycle channel supplier and the manufacturer may have conflict of interests in supply risk reduction when the supply risk is low, and their interests are aligned when the supply risk is high.

Keywords: Supply chain management, closed-loop supply chain, remanufacturing, double marginalization, supply chain risks