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Two-way product recovery in a closed-loop supply chain with variable markup under price and quality dependent demand

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Abstract This article considers a two-way product recovery in a two-echelon closed-loop supply chain which comprises one manufacturer and one retailer for trading a single product. The market demand of the product is linearly dependent on selling price and product quality. The retailer sets the selling price with a variable markup on the wholesale price of the manufacturer. The manufacturer also sets his wholesale price with a fixed markup on the production cost of the product. The retailer recovers the used product in two ways. He collects from consumers the used products, which is a fraction of newly sold products in the forward channel. He also collects the used products through an exchange offer and replaces a fraction of the collected used products by new ones. We analyze the proposed model under four different decision structures: decentralized (Nash game), manufacture-led and retailer-led Stackelberg games and Centralized (cooperative game). We then compare these policies to identify the best policy. We also examine the feasibility of the cooperative game through a bargaining model. To examine the effects of key model-parameters on the decisions, we perform a sensitivity analysis for a numerical example.

Keywords: Two-way product recovery; exchange offer; product quality; variable markup; closed-loop supply chain.

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