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Joint Inventory Control and Pricing in a Service-Inventory System

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Abstract: This study addresses joint inventory control and pricing decisions for a service-inventory system. In such a system both an on-hand inventory item and a positive service time are required to fulfill customer demands. The service-inventory system also captures main features of the classical inventory systems with a positive processing time, e.g., make-to-order systems. In this study the service-inventory system is modeled as an $M/M/1$ queue in which the customer arrival rate is price dependent. The inventory of an individual item is continuously reviewed under an $(r,Q)$ policy. The replenishment lead times of the inventory are exponentially distributed. Furthermore, customers arriving during stock-out periods are lost. The stochastic customer inter-arrival times, service times, and inventory replenishment lead times cause the high complexity of the problem and the difficulty in solving it. The aim of this study is to formulate the problem and solve it to optimality. We make three main contributions: (1) We integrate inventory control and pricing in the service-inventory system. The problem is formulated and analyzed as a fractional programming problem, and structural properties are explored for the model. (2) Two solution algorithms are proposed. The first one provides optimal solutions, while the second one is more efficient. (3) The impact of the integrated inventory control and pricing decisions on the overall system performance is investigated. We compare the solutions of the models both with and without fill-rate and service-reliability constraints and report the main interesting managerial insights.

Keywords: Service-inventory system; Inventory control; Pricing; Operations-marketing interface.

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