Abstract

This paper considers a two-echelon distribution system which consists of a single warehouse serving \( N \) (possibly non-identical) retailers that face discrete stochastic demand of the customers. The warehouse orders from an exogenous supplier with ample stock. Orders arrive at the warehouse after a fixed leadtime. The warehouse satisfies, if possible, the replenishment requests from the retailers. In case of insufficient stock, the available stock is allocated to the retailers. The shipments from the warehouse reach their final destinations after a further fixed leadtime. Excess demand at the retailers is backlogged, and linear holding and penalty costs are incurred. We assume periodic review and centralized control, and the objective is to minimize the average expected inventory holding and penalty costs. Under the so-called balance assumption (also known as the allocation assumption), we show that base stock policies are optimal. Actually, we extend the optimality of base stock policies for continuous demand models under the balance assumption to the discrete demand case. Further, we derive newsboy inequalities for the optimal base stock levels and develop an efficient algorithm for the computations of an optimal policy.

Subject classifications: Inventory/Production: multi-echelon, periodic review, stochastic discrete demand, optimal policy, newsboy characterizations.

Area of review: Manufacturing, Service and Supply Chain Operations.