A THREE-STAGE MODEL FOR A DECENTRALIZED DISTRIBUTION SYSTEM OF RETAILERS

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We present and study a three-stage model of a decentralized distribution system consisting of \( n \) retailers, each of whom faces a stochastic demand for an identical product. In the first stage, before the demand is realized, each retailer independently orders her initial inventory. In the second stage, after the demand is realized, each retailer decides how much of her residual supply/demand she wants to share with the other retailers. In the third stage, residual inventories are transshipped to meet residual demands, and an additional profit is allocated. Our model is an extension of the two-stage model of Anupindi et al. (ABZ) (2001), which implicitly assumes that all residuals enter the transshipment stage. We show, however, that allocation rules in the third stage based on dual solutions, which were used in the ABZ model, may induce the retailers to hold back some of their residual supply/demand. In general, we study the effect of implementing various allocations rules in the third stage on the values of the residual supply/demand the retailers are willing to share with others in the second stage, and the trade-off involved in achieving an optimal solution for the corresponding centralized system.

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