

Inventory Sharing on Commodity Procurement: Sequence of Decisions and Transfer Prices

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Abstract

This paper studies commodity procurement policies in the presence of inventory sharing. We consider two independent firms that use a common commodity input to satisfy stochastic demands in a multi-period setting. The firms can procure the commodity as well as sell excess inventory through either the spot or the forward market. The firms can also share the commodity between them when one has leftover inventory while the other has excess demand. We choose as benchmarks the no-sharing solution and the centralized solution. With stochastic prices, the changing price necessitates closer coordination. We consider two ways to coordinate inventory sharing: sequence of decisions and transfer prices. First, we consider the case that the firms make decisions simultaneously and the case that the firms make decisions one after the other. We find that independent movement provides a better solution especially if the pricing of the sharing transactions is chosen wisely. Second, due to the stochastic nature of spot and forward prices, the benefits per unit of inventory shared changes over time. We propose a method such that firms get the same benefits per unit of the sharing transactions. The proposed method is fair for the borrower and lender and seems to work very well, i.e., the gap with respect to the centralized solution is negligible in our experiments. We finally identify how the benefits from sharing inventory vary with the parameter values of the demand and the transaction costs. The value of inventory sharing, using our proposed pricing scheme, increases as the mean and variance of demand increase, the correlation between the demand faced by firms decreases or the sharing transaction cost decreases. The value may either increase or decrease as the transaction costs in the spot increase.