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Selling to the censored newsvendor: optimal wholesale price with downstream demand learning

(joint work with Fangruo Chen)

Abstract: We study a supply chain with one supplier and one retailer. The retailer's knowledge about its (uncertain) demand can be improved over time by means of Bayesian updating. This learning process is hampered by the fact that when the demand in a period exceeds the on-hand inventory, the excess demand is lost and thus not observed by the retailer. Therefore the retailer's inventory policy actually influences its ability to learn about demand. The supplier follows a policy that charges a constant wholesale price over time. We aim to understand that how the retailer's "learning" behavior in this setting impacts the supplier's optimal wholesale price decision, and in consequence, the two parties' profits, and the supply chain efficiency. In comparison to the case with a myopic retailer, we showed that the optimal wholesale price offered to the "learning" retailer is always lower, and Pareto-improving. Motivated by the fast growth of e-commerce, we also compared our model with a setting when the lost sales are observable, and characterized the differences in various performance measures. Both numerical and analytical results are provided.