

SEMINAR SERIES

**Department of Quantitative Analysis and Operations Management
University of Cincinnati**

A Dynamic Inventory Model with the Right of Refusal

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Abstract: We consider a dynamic inventory (production) model with general convex order (production) costs and excess demand that can be accepted or refused by the firm. Excess demand that is accepted is backlogged and results in a backlog cost whereas demand that is refused results in a lost sales charge. Endogenizing the sales decision is appropriate in the presence of general convex order costs so that the firm is not forced to backlog a unit whose subsequent satisfaction would reduce total profits. In each period, the firm must determine the optimal order and sales strategy. We show that the optimal policy is characterized by an optimal buy-up-to level that increases with the initial inventory level and an order quantity that decreases with the initial inventory level. More importantly, we show the optimal sales strategy is characterized by a critical threshold, a *backlog limit*, that dictates when to stop selling. This threshold is independent of the initial inventory level and the amount purchased. We investigate various properties of this new policy. As demand stochastically increases, the amount purchased increases but the amount backlogged decreases, reflecting a shift in the way excess demand is managed. We develop two regularity conditions, one that ensures some backlogs are allowed in each period, and another that ensures the amount backlogged is nondecreasing in the length of the planning horizon. We illustrate the buy-up-to levels in our model are bounded above by buy-up-to levels from the pure lost sales and pure backlogging models. We explore additional extensions using numerical experiments.

Bio: John Semple is the Charles Wyly Professor of MIS and Chairman of the Information Technology and Operations Management Department at the Cox School of Business, SMU. He earned his B.Sc. and M.Sc. degrees in Mathematics from McGill University, and his PhD in Management Science/Mathematics from the University of Texas at Austin. He has published over 30 papers on a variety of topics in mathematical modeling as it applies to business. His current research focuses on inventory management, optimal product positioning/pricing, and applications of point-of-sale data to problems in operations and marketing. His papers have appeared in *Management Science*, *Operations Research*, *Marketing Science*, *Mathematical Programming*, *Journal of Optimization Theory and Applications*, and *IIE Transactions*, among others. He teaches courses in decision modeling, statistics, and revenue management.

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