

The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

Supply and Demand Functions in Inventory Models

by

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Venue: N116, Block N

The Hong Kong Polytechnic University

(Conducted in English)

Abstract:

The heart of an inventory model is the modeling of the supply and demand functions. To allow for analytical tractability, the existing literature focuses on *almost surely linear* supply and demand functions, which greatly limits the applicability of the models. The goal of this paper is to provide a unified approach to analyze general random supply and demand functions. By transforming the problem into one defined on a higher dimension, we show that many of the seemingly highly nonlinear supply and demand functions (in the almost sure sense) are linear in the *stochastic* sense. With this new notion of linearity, called the *stochastic linearity in mid-point*, our ability to analyze inventory and supply chain problems is much enhanced. We are able to prove the concavity of the profit function in the transformed inventory and pricing decisions for a general class of supply and demand functions that cover and go much beyond the ones studied in the existing literature. We further show that when the supply functions are stochastically increasing in the dispersive order, a condition satisfied by almost all the supply functions analyzed in the existing literature, the optimal ordering decision follows an almost threshold policy—When the inventory level is above a threshold, no order is placed to the supplier; otherwise, a positive order is issued to the supplier with exception over a set of inventory levels with zero Lebesgue measure. If, in addition, the demand distribution is continuous, this policy reduces to a strict threshold policy and it is optimal to

select the suppliers based on per unit cost of delivery. To demonstrate the applicability of these theoretical developments, we analyze several known and new examples of supply and demand functions. We also present a nonparametric approach to show how one can empirically estimate and verify the stochastic properties of the supply and demand functions.

This is a joint work with J. George Shanthikumar.

Bio:

Qi Annabelle Feng is the John and Donna Krenicki Chair in Operations Management at Krannert School of Management, Purdue University. She was previously a faculty member at McCombs School of Business, The University of Texas at Austin. She received her Ph.D. in Operations Management from UT Dallas in 2006. Her main research interest lies in studying firms' sourcing decisions in the broad context of supply chain management. Her main research interest lies in studying firms' sourcing decisions in the broad context of supply chain management. Her work focuses on individual firm's procurement planning in uncertain environment and multiple firms' interactions in sourcing relationships. She also works in the areas of product development and proliferation management, resource planning, economic growth models, and information system management. She is currently a Department Editor for Production and Operations Management. She received the first prize in the INFORMS Junior Faculty Paper Competition in 2009, Franz Edelman Award in 2009 and the Wickham Skinner Early-Career Research Accomplishment Award in 2012.

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All are welcome!