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IAS Distinguished Lecture

Supply and Demand Functions in Inventory Models

Professor J. George Shanthikumar

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Date : 15 March 2016 (Tuesday)
Time : 2:30 pm – 4:00 pm
Venue : Room 7-208, 7/F, Academic 3 (AC3), City University of Hong Kong

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 lecture 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 Lebegue 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 Qi Annabelle Feng.

Biography

J. George Shanthikumar is the Richard E. Dauch Chair Professor of Manufacturing and Operations Management, a University Distinguished Professor of Management and Co-Academic Director of the MS program in Global Supply Chain Management at the Krannert School of Management, Purdue University, West Lafayette, IN. Before joining Purdue, he was a Chancellor's Professor of Industrial Engineering and Operations Research at the University of California, Berkeley, CA. He received the B. Sc. degree in mechanical engineering from the University of Sri Lanka, Peradeniya, and the M. A. Sc. and Ph. D. degrees in industrial engineering from the University of Toronto, Toronto, Canada. His research interests are in model uncertainty & learning, production systems modeling and analysis, queueing theory, reliability, scheduling, semiconductor yield management, simulation, stochastic processes, and supply chain management. He has written or written jointly over 300 papers on these topics. He is a co-author (with John A. Buzacott) of the book *Stochastic Models of Manufacturing Systems* and a co-author (with Moshe Shaked) of the book *Stochastic Orders and Their Applications* and the book *Stochastic Orders*. He is a Fellow of the Institute for Operations Research and Management Science (INFORMS) and Production and Operations Management (POM) Societies.

He is a member of the editorial advisory boards of *Asia-Pacific Journal of Operations Research* and *IEEE Transactions on Automation Sciences and Engineering*, and an area editor for *Journal of the Production and Operations Management Society*. He was a member of the editorial advisory board of *Journal of the Production and Operations Management Society*, was a co-editor of *Flexible Services & Manufacturing Journal*, area editor for *Operations Research Letters* and was an associate editor for *IIE Transactions, International Journal of Flexible Manufacturing Systems*, *Journal of Discrete Event Dynamic Systems, Operations Research, OPSEARCH, Probability in the Engineering and Informational Sciences* and *Queueing Systems: Theory and Applications*.

Dr. Shanthikumar has extensively consulted for various companies like **Applied Materials** (AMAT), **Bellcore**, **IBM**, **KLA-Tencor**, **NTT** (Japan), **Intel**, **Intermolecular**, **Reel Solar**, **Safeway**, and **Southern Pacific Railways** and through KLA-Tencor worked on Joint Development Projects for **AMD**, **IBM**, **Intel**, **LSI**, **Motorola**, **TI**, **Toshiba**, **Fujitsu**, **TSMC** and **UMC**. He is an advisory consultant for **Sensor Analytics** and a member of the technical advisory board of **Inter Molecular Inc.** and **Reel Solar, Inc**.

All are welcome

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