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

Data-Driven Research in Revenue Management: The Impact of Model Misspecification

by

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Date: 3 January 2020 (Friday)
Time: 10:30am - 11:30am
Venue: M802, Li Ka Shing Tower
The Hong Kong Polytechnic University*

(*The venue is subject to change due to unforeseen circumstances. Please pay attention to our further notice.)

(Conducted in English)

Abstract:

In many retail settings the demand function is unknown a priori and price experimentation is typically suggested for learning demand parameters. In practice, however, sellers are faced with a few challenges including model misspecification, inability to conduct experimentations and limited inventory. In this talk we show how data-driven research fosters the development of new engineering and scientific methods that help explain, predict, and change behavior while improving business performance.

Collaborating with Oracle Retail business, we study a multi-period dynamic pricing problem with contextual information where the seller uses a mis-specified demand model. The seller sequentially observes past demand, updates model parameters, and then chooses the price for the next period based on time-varying features. We show that model misspecification leads to correlation between price and prediction error of demand per period, which in turn leads to inconsistent price elasticity estimate and hence suboptimal pricing decisions. We propose a "random price shock" (RPS) algorithm that dynamically generates randomized price shocks to estimate price elasticity while maximizing revenue. We show that the RPS algorithm has strong theoretical performance guarantees, that it is robust to model misspecification, and that it can be adapted to a number of business settings, including (1) when the feasible price set is a price ladder, and (2) when the contextual information is not IID. We also perform numerical experiments gauging the performance of RPS on a large fashion retail dataset, and find that it is expected to earn 8-20% more revenue on average than competing algorithms that do not account for price endogeneity.

Bio:

David Simchi-Levi is a Professor of Engineering Systems at MIT. He is considered one of the premier thought leaders in supply chain management and business analytics. His research focuses on developing and implementing robust and efficient techniques for operations management. He has published widely in professional journals on both practical and theoretical aspects of supply chain and revenue management.

His Ph.D. students have accepted faculty positions in leading academic institutes including U. of California Berkeley, Carnegie Mellon U., Columbia U., Cornell U., Duke U., Georgia Tech, Harvard U., U. of Illinois Urbana-Champaign, U. of Michigan, Purdue U. and Virginia Tech.

Professor Simchi-Levi co-authored the books *Managing the Supply Chain* (McGraw-Hill, 2004), *the award winning Designing and Managing the Supply Chain* (McGraw-Hill, 2007) and *The Logic of Logistics* (3rd edition, Springer 2013). He also published *Operations Rules: Delivering Customer Value through Flexible Operations* (MIT Press, 2011).

Professor Simchi-Levi is the current Editor-in-Chief of *Management Science*, one of the two flagship journals of *INFORMS*. He served as the Editor-in-Chief for Operations Research (2006-2012), the other flagship journal of *INFORMS* and for *Naval Research Logistics* (2003-2005). He is an *INFORMS* Fellow, MSOM Distinguished Fellow and the recipient of the 2014 *INFORMS* Daniel H. Wagner Prize for Excellence in Operations Research Practice; 2014 *INFORMS* Revenue Management and Pricing Section Practice Award; 2009 *INFORMS* Revenue Management and Pricing Section Prize and Ford 2015 Engineering Excellence Award.

Professor Simchi-Levi has consulted and collaborated extensively with private and public organizations. He was the founder of LogicTools which provided software solutions and professional services for supply chain optimization. LogicTools became part of IBM in 2009. In 2012 he co-founded OPS Rules, an operations analytics consulting company. The company became part of Accenture in 2016. In 2014, he co-founded Opalytics, a cloud analytics platform company focusing on operations and supply chain intelligence. The company became part of the Accenture Applied Intelligence in 2018.

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All are welcome!