Faculty of Business Administration

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Operations Research

"Managing Inventory Replenishment and Product Substitution for Systems under a Flexible Substitution Scheme"

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Abstract

Global competition has driven firms to offer better services to customers at lower prices, and to improve inventory management. We study three drivers to a firm's competitive position: price, inventory and customer service --- their interplay and the synergistic integration of all three in a decision model. Specifically, we study a multi-product inventory system, where the products can substitute for one another if needed, so as to improve the order fill rate, and hence customer service. Products can be used to supply demand over a selling season of N periods, with a one-time replenishment opportunity at the beginning of the season. The substitution rule is flexible in the sense that the supplier can choose whether or not to offer substitution with products in stock and at what price or discount level, whereas the customer may or may not accept the offer, with the acceptance probability depending on the customer's preference and the substitution price. The decisions are the replenishment quantities at the beginning of the season, and the dynamic substitution-pricing policy in each period of the season. Using a stochastic dynamic programming approach, we present a complete solution to the two-product problem. Furthermore, we show the value function satisfies certain important structural properties (including concavity and submodularity), which facilitate the solution procedure and help identify threshold policies for the optimal substitution-pricing decisions. These also provide guidance for us to propose a heuristic policy for the multi-product problem. We demonstrate that the flexible substitution model not only unifies and extends the traditional supplier-driven and customer-driven substitutions, it outperforms significantly both schemes.

Date: **May 20, 2010 (Thursday)**

Time: **15:30 – 17:00**

Venue: **JM21**

ALL ARE WELCOME!

A Short Biography of Prof. Shaohui Zheng

Prof. Zheng got his Ph.D. in Operations Research from Columbia University in 1994. He joined the HKUST as an assistant professor in 1994. His main areas of research include Supply Chain Management, Interface of Marketing and Supply Chain, Production and Quality Control and Applied Probability Models. His publications appear in top academic journals such as *Operations Research*, *Management Science* and *IIE Transactions*. Currently, Prof Zheng is the referee for *Management Science*, *Operations Research*, *Mathematics of Operations Research*, *Operations Research Letter*, *Naval Research Logistics*, *Queueing Systems*, *IEEE Transactions on Automatic Control*, *IEEE Transactions on Reliability*, and *IIE Transactions*. Prof. Zheng has also served in a number of journal editorial boards. Currently, he is the associate editor of *Operations Research*.