Contracting for On-Time Delivery in the U.S. Influenza Vaccine Supply Chain

Tinglong Dai
Assistant Professor of Operations Management
Carey Business School, Johns Hopkins University

ABSTRACT

Motivated by the influenza vaccine industry, we study a supply chain contracting problem in the presence of uncertainties surrounding product design, delivery, and demand. In the supply chain, a retailer places an order before a flu season starts and a manufacturer decides on when to produce vaccines. Because production after a design freeze can result in late deliveries and hence lost sales, the manufacturer in practice initiates production prior to the design freeze at its own risk. However, since it is the retailer who reaps most benefits from selling more vaccines delivered on time, the manufacturer has little incentive to undertake at-risk production, which in turn induces the retailer to reduce the order size in anticipation of lost sales; and this further discourages the manufacturer from making efforts to improve its delivery performance. We proceed to show that the Delivery-time-dependent Quantity Flexibility (D-QF) contract, a contract adopted in practice, may not coordinate the supply chain due to the tension between overcoming double marginalization and incentivizing early production; another contract used in practice, the Late-Rebate (LR) contract, nearly coordinates the supply chain when demand uncertainty is low. We propose a Buyback-and-Late-Rebate (BLR) contract that combines buyback with rebate for late deliveries and can both coordinate the supply chain and provide flexibility of profit division. Our numerical analysis suggests that the total supply chain profits can be improved by over 10%, on average, compared with the contracts currently used in this industry.
SPEAKER BIO

Tinglong Dai is an Assistant Professor of Operations Management at Carey Business School of the Johns Hopkins University. He received a Ph.D. in Operations Management / Robotics (2013), jointly offered by Tepper School of Business and the Robotics Institute of Carnegie Mellon University, with a dissertation entitled "Incentives in U.S. Healthcare Operations." He also received an M.S. in Industrial Administration from Carnegie Mellon in 2009, an M.Phil. in Industrial Engineering and Engineering Management from the Hong Kong University of Science and Technology in 2006, and a B.Eng. in Automation from Tongji University in 2004.

Dr. Dai is the recipient of the 2012 POMS Best Paper in Healthcare Award, the 2012 INFORMS Pierskalla Runner Up Award for the Best Paper in Healthcare, and 2nd Place Award in the 2012 INFORMS Case and Teaching Materials Competition. He is a finalist in the 2014 Elwood S. Buffa Doctoral Dissertation Award, and the 2013 POMS College of Supply Chain Management Best Student Paper Competition. His research has been published in leading journals such as Management Science. He has been quoted in MedPageToday.com, Baltimore Sun, and Maryland Daily Record.

His research areas include Healthcare Operations, Healthcare Supply Chain, Marketing-Operations Interfaces, Strategic Queuing Design, and Distributed Optimization.