

Industrial and Systems Engineering Seminar

Price Competition in Sequential Multi-Product Oligopolies

Wednesday, February 13

3:15 PM – Refreshments before the Seminar

3:30 PM – Graduate Seminar

Mechanical Engineering Room 4125 A & B



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We analyze a general model in which, at each echelon of the supply process, an arbitrary number of firms compete, offering one or multiple products to some or all of the firms at the next or possibly subsequent echelons or directly to the end consumer. At each echelon, the offered products are differentiated and the firms belonging to this echelon engage in price competition. The model assumes a general set of consumer demand functions for all products (potentially) brought to the consumer market, where each product's demand volume may depend on the retail prices charged for all products; consumers' preferences over the various product/retailer combinations are general and asymmetric. Similarly the cost rates incurred by the firms at the most upstream echelon are general as well.

We initially study a two-echelon sequential oligopoly with competing suppliers, each selling multiple products indirectly through a pool of multiple competing retailers or directly to end consumers. In some cases, a supplier may choose to sell some or all of its products simultaneously via its direct sales channel and indirectly via some or all of the retailers. We characterize the equilibrium behavior under linear price-only contracts. In the second stage, given wholesale prices and prices of direct sales channels selected in the first stage, all retailers simultaneously decide on their retail prices to maximize their total profits among all products of all suppliers they choose to do business with. In the first stage, the suppliers anticipate the retailers' responses and all suppliers simultaneously maximize their total profits from all channels -- direct or indirect channels -- by selecting the wholesale prices and direct sales channel prices. We show that in this two-stage competition model, a subgame perfect Nash equilibrium always exists. Multiple subgame perfect equilibria may arise but, if so, all equilibria are equivalent in the sense of generating unique demands and profits for all firms. We subsequently generalize our results to supply chain models with an arbitrary set of echelons, and show how all equilibrium performance measures can be computed with an efficient recursive scheme. The model can be used to evaluate the impact of various structural changes in the supply chain network, e.g., to study the cost pass-through problem, to measure the brand value and to evaluate the impact of vertical integration on equilibrium prices and product assortments.

Ming Hu is an Assistant Professor of Operations Management at the Rotman School of Management, University of Toronto. Dr. Hu's current research explores the interface between operations management and marketing, with a focus on applying game theory to analyze strategic interactions among firms, and between firms and consumers, in the typical context of operations management such as revenue management, supply chain management and service management. Ingredients of his theoretic modeling often include mechanism design, integration of inventory/capacity and pricing, price competition of differentiated products, and strategic consumer behavior. During 2008-2011, Dr. Hu received the prestigious Hewlett-Packard Innovation Award and in 2011, he won the Connaught New Researcher Award at University of Toronto. Dr. Hu received a bachelor's degree in Mathematics from Nanjing University in China in 2001; a master's degree in Applied Mathematics from Brown University in 2003; and a Ph.D. in Operations Research from Columbia University in 2009. <http://www.rotman.utoronto.ca/FacultyAndResearch/Faculty/FacultyBios/Hu.aspx>