

Supply Chain Management SIG Program Schedule

Each speaker will have 30 minutes. The discussant is allowed 5 minutes, followed by 10 minutes of general discussion.

Registration begins at 7:30am

Session 1 :: 8:00am-9:30am

8:00am

Title: An Analysis of Monopolistic and Competitive Take-Back Schemes for WEEE Recycling

Authors: Fuminori Toyasaki, Tamer Boyaci, Vedat Verter

Discussant: Laurens Debo

The establishment of efficient take-back schemes is widely recognized as the first step of achieving high product recovery and recycling rates. In this paper, we study two prevailing types of take-back schemes for electrical and electronic equipment waste (WEEE) recycling: Monopolistic and Competitive. We address key market and operating factors that make one scheme preferable to the other from the viewpoints of the recyclers, manufacturers, and consumers. To this end, we model competitive decision making in both take-back schemes as two-stage sequential games between competing manufacturers and recyclers. Deriving and computing equilibria, we find that the competitive take-back schemes often accomplish a win-win situation; i.e., lower product prices as well as higher recycler and manufacturer profits. Exceptionally, the recyclers prefer the monopolistic scheme when substitutability level between the manufacturers' original products is high. We show that consolidation of recycling industry could be beneficial to all stakeholders when the economies of scale in recycling/logistics activities are strong. Higher collection rates and lower product substitutability also render recycler consolidation desirable for all stakeholders. Furthermore, we identify a potential free-rider problem in the monopolistic scheme when the recyclers differ in operational efficiency, and propose mechanisms to eliminate it. We illustrate some of our results through numerical experiments and discuss the implications of our results to policy makers.

8:45am

Title: Remanufacturing Under Take-Back Legislation: Cost Benefits or Potential Competition?

Authors: Gokce Esenduran, Eda Kemahlioglu-Ziya, Jayashankar Swaminathan

Discussant: Scott Webster

We consider an original equipment manufacturer (OEM) in an industry regulated with take-back legislation. The legislation holds the OEM responsible for either taking back and properly treating products that reach the end of their life cycles or facilitating such take back and proper treatment through third parties. We use a stylized model of take-back legislation and analyze three levels of legislation (no take-back legislation, legislation on collection levels, legislation on collection and reuse levels) in two different supply-chain settings using a two-period model. We

first consider an OEM with in-house remanufacturing capabilities and derive her optimal strategies in production levels for new and remanufactured products, core collection levels and the related pricing decisions. We characterize the parametric regions where take-back legislation is redundant. We find that while take-back legislation never causes a decrease in remanufacturing levels, it may cause a drop in the manufacturing levels of new products when the manufacturing cost is low. Thus increased remanufacturing levels do not necessarily mean lower-priced remanufactured goods. We also derive the optimal strategies for an OEM who does not/cannot remanufacture in-house but competes with a third-party remanufacturer. We find that the OEM never allows the remanufacturer to collect cores from the market; rather she prefers selling to the remanufacturer by either pricing the cores lower than the remanufacturer's collection cost or by preemptively collecting all cores herself. Finally when we compare the effect of legislation on the monopoly and competition models we find that remanufacturing levels and prices may be higher in the latter.

Session 2 :: 10:00am-11:30am

10:00am

Title: Rationing of HIV treatment in resource-constrained settings under supply uncertainty

Authors: Sarang Deo, Charles Corbett

Discussant: Prashant Yadav

Currently, less than a fifth of the eligible HIV / AIDS patients in developing countries receive highly active antiretroviral therapy (HAART). Supply chain management and logistics are often cited among the biggest challenges in scaling up HAART. In addition to the aggregate shortage, clinics in these countries have to contend with uncertain supply resulting from inadequate supply management skills and a weak infrastructure. This supply uncertainty, combined with the clinical importance of an uninterrupted treatment throughout patients' life, leads to a trade-off between improving access to treatment for new patients and improving quality of treatment for current patients. We consider an individual clinic facing this trade-off and derive its optimal treatment rationing policy using stochastic dynamic programming. We show that under certain conditions the optimal policy coincides with the clinically preferred policy of prioritizing previously enrolled patients. Our numerical illustrations suggest that the performance of enrollment policies used in practice can be substantially suboptimal. We also discuss the applicability of our model to the resource allocation decision in non-profit organizations where continuity of service is crucial to meeting the organization's social objective.

10:45am

Title: Relicensing as a Secondary Market Strategy

Authors: Nektarios Oraopoulos, Mark Ferguson, Beril Toktay

Discussant: Tamer Boyaci

Secondary markets in the Information Technology (IT) industry, where used or refurbished equipment is traded, have been growing steadily. For Original

Equipment Manufacturers (OEMs) in this industry, the importance of secondary markets has grown in parallel, not only as a source of revenue, but also because of their impact on these firms' competitive advantage and market strategy. Recent articles in the press have severely criticized some OEMs who are perceived to be actively trying to eliminate the secondary market for their products. Others have policies that enhance their secondary markets. The goal of this paper is to understand how an OEM's incentives and optimal strategies vis-a-vis the secondary market are shaped contingent on her relative competitive advantage, product characteristics and consumer preferences. The critical tradeoff that we examine is whether the indirect benefit from maintaining an active secondary market (the resale value effect) can outweigh the potentially negative effect of the sales of used products at the expense of new product sales (the cannibalization effect). To that end, we develop a model where the OEM can directly affect the resale value of her product through a relicensing fee charged to the buyer of the refurbished equipment. Moreover, we introduce a measure of the consumers' willingness to return their used products to account for the fact that the higher the price offered by a third-party entrant, the higher the ratio of returned products at their end-of-use. We analyze the OEM's decision in both the monopoly and the duopoly cases, characterize the optimal relicensing fee set by the OEM, and draw conclusions on the conditions that favor stimulating or deterring the secondary market.

Session 3 :: 12:30pm-2:00pm

12:30pm

Title: Routing for Relief Efforts

Authors: Ann Campbell, Dieter Vandenbussche, William Hermann

Discussant: Vedat Verter

In the aftermath of a large disaster, the routing of vehicles carrying critical supplies can greatly impact the arrival times to those in need. Since it is critical that the deliveries are both fast and fair to those being served, it is not clear that the classic cost-minimizing routing problems properly reflect the priorities relevant in disaster relief. In this paper, we take the first steps in developing new methodologies for these problems. We focus specifically on two alternative objective functions for the TSP and VRP: one that minimizes the maximum arrival time (minmax) and one that minimizes the average arrival time (minavg). To demonstrate the potential impact of using these new objective functions, we bound the worst case performance of optimal TSP solutions with respect to these new variants and extend these bounds to include multiple vehicles and vehicle capacity. Similarly, we examine the potential increase in routing costs that result from using these alternate objectives. We present solution approaches for these two variants of the TSP and VRP which are based on well known insertion and local search techniques. These are used in a series of computational experiments to help identify the types of instances where TSP and VRP solutions can be significantly different from optimal minmax and minavg solutions.

1:15pm

Title: Decentralized Inventory Sharing with Asymmetric Information

Authors: Hui Zhao, Xinghao Yan

Discussant: Candace Yano

Almost all previous literature on inventory sharing has assumed that the retailers' demand information is known to each other. Such an assumption is far from the reality for decentralized supply chains. In this paper, we study an inventory sharing game between two retailers who privately hold demand information, non-cooperatively determine their order quantities, but cooperatively share inventory with each other. Characterizing retailers' Bayesian Nash equilibrium order quantities when no demand information is shared between the retailers (NIS), we find that sharing demand information does not always benefit retailers. However, a coordination mechanism can be developed if the retailers truthfully share demand information with each other before they each make ordering decisions. Unfortunately, an incentive compatibility analysis shows that the retailers have the incentives to untruthfully reveal their demand information under such coordination mechanism. A truth-inducing scheme is then designed which, together with the coordination mechanism, achieves the coordination of the retailers and guarantees an all-win situation compared to any other non-coordinating scenario, e.g., NIS and FIS. To our knowledge, this paper is the first attempt to study inventory sharing systems with asymmetric information.

Session 4 :: 2:30pm-4:00pm

2:30pm

Title: Quality Competition under Yield Uncertainty

Authors: Awi Federgruen, Nan Yang

Discussant: Steve Gilbert

We characterize the equilibrium behavior in an industry with N potential suppliers with less than fully reliable yield processes, competing for the business of M buyers, in a single sales season. To facilitate the exposition, we initially consider a single purchasing firm or agency; however almost all of our results carry over to the general oligopsony case with an arbitrary number of buyers. The purchasing firm faces an uncertain demand volume, while each of the suppliers experiences a given random yield factor. In the face of combined demand and supply risks, the purchasing firm determines a total order size and its allocation among the various potential suppliers, minimizing purchasing costs while ensuring that a shortfall can be avoided with a prespecified maximum shortfall probability. By adopting appropriate technologies, materials and manufacturing processes, suppliers are able to select either (i) the yield predicability, as measured by an appropriately chosen decreasing function of the coefficient of variation (c.v.) of the yield factor, or (ii) a yield target, i.e. the mean of the yield distribution, or (iii) both the yield target and the yield predicability.

The manufacturing cost rate increases with the selected yield target and yield predicability. Depending on which of the settings (i), (ii) or (iii) prevails, we thus distinguish between three types of competition, which we refer to, respectively, as

(I) Yield Predicability Competition, (II) Yield Target Competition, and (III) Simultaneous Yield Target and Predicability Competition.

The competition models are Stackelberg games, in which the suppliers start out making their yield choices and the purchasing firm follows by determining how much it wants to order from each. When an individual supplier increases either his yield target or his yield predicability, this results in an increase of his market share, although not necessarily of his expected sales volume. Since the yield improvement also results in a reduced profit margin, this gives rise to an intricate set of tradeoffs in each of the three competition models.

We provide a full characterization of the equilibrium behavior in the various competition models and discuss mechanisms by which suppliers can be induced to adopt higher quality standards.

3:15pm

Title: Strategic Information Management Under Leakage in a Supply Chain

Authors: Krishnan Anand, Manu Goyal

Discussant: Allan Scheller-Wolf

The importance of material flow management for a profit-maximizing firm has been well-articulated in the supply chain literature. We demonstrate in our analytical model that a firm must also actively manage information flows within the supply chain, which translates to controlling what it knows, as well as what its competitors and suppliers know. In our model of horizontal competition between an informed and an uninformed firm with a common upstream supplier, material and information flows intersect through leakage of information to unintended recipients. As a result, when a firm acquires information, its drive to control information flows within the supply chain can trigger operational losses through material flow distortion. Hence the firm may prefer not to acquire information even when it is costless to do so. However, if acquired, demand information is always disseminated in the supply chain, aided by leakage. This result is in stark contrast to the extant literature which argues that demand information is not shared in similar settings. Thus, in equilibrium, information asymmetry is dissipated in the supply chain – either all firms are privy to demand information or none are. Our results underscore the importance of Strategic Information Management – actively managing the supply chain's information flows, and making trade-offs with material flows where appropriate, in order to maximize profits.