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Research and Management Insights

Optimal Policies for Recovering the Value of Consumer Returns
Keith J. Crocker, Paolo Letizia

When consumers return a previously purchased product to a retailer, an appropriate and timely disposition of the return is of paramount importance. The retailer could choose to incur a cost to refurbish and resell the product or, alternatively, she could simply return the product to the manufacturer. The returns policies adopted by manufacturers affect the course of action taken by retailers and the efficiency of the supply chain. Keith Crocker and Paolo Letizia characterize the most efficient returns policies that could be adopted by a manufacturer, which provides a rationale for the large variety of such policies observed in practice. In settings where early disposition of the returned products is important, a manufacturer's returns policy must provide the manufacturer with the incentive to undertake investments to reduce the probability of a product return, on one hand, while also providing the retailer with the incentive to refurbish and resell the returned product rather than sending it back to the manufacturer, on the other. The authors find that the (Pareto) optimal returns policy consists of a refund of the wholesale price to the retailer, coupled with a bonus which decreases with the number of returns to the manufacturer.

Stimulating Early Adoption of New Products through Channel Disintegration
Ram N.V. Ramanan, Hemant K. Bhargava

Conventional wisdom holds that the vertical disintegration of manufacturing and distribution functions reduces the firm's profit. When these functions are separated into an upstream and a downstream firm who sequentially set monopoly prices, "double marginalization" occurs, customers face higher prices, and fewer customers purchase. Ram Ramanan and Hemant Bhargava demonstrate that this conventional wisdom does not hold true in a dynamic pricing environment in which uncertain customers learn over time the alignment of their personal tastes with the product's features. The valuation uncertainty that customers initially face, especially in the context of newly released products, can make vertical disintegration desirable for both the supply chain and its customers. With an integrated supply chain, an uncertain customer may delay adopting the product and choose to wait, hoping for favorable future prices. Whereas, with supply chain disintegration, the downstream firm faces a higher cost structure, which binds it into keeping future prices high. This enables the supply chain to credibly signal to customers that future prices will remain high, pushing them towards early adoption. The increased demand for early adoption benefits the channel, as it sells to more customers. Customers also benefit, as the increased demand leads to lower prices for early adopters.

Customers' Capital Market Information Quality and Suppliers' Performance
Suresh Radhakrishnan, Zheng Wang, Yue Zhang

There is widespread belief that supply chain managers do not incorporate incentives for customers to provide better quality demand information. As such, recent research examines how customers' and suppliers' incentives can be aligned so that customers provide credible and reliable demand information. Considerable information intended for investors and creditors is available in the capital markets, albeit at an aggregate level, and can be used either directly or indirectly by suppliers to evaluate the customers' demand information quality. Suresh Radhakrishnan, Zheng Wang, and Yue Zhang find a positive association between customers' capital market information quality measured by their provision of earnings forecasts, reported earnings quality, and coverage by financial analysts and credit rating agencies, and suppliers' operating performance measured by the DuPont profitability ratios – return on assets, profit margins and asset turnover ratios. This association is strong in settings where customers' demand information quality is important for suppliers. These results suggest that supply chain managers may not need to incorporate direct incentives for customers to provide better quality demand information, especially for those customers whose capital market information quality is high.

Outsourcing Competition and Information Sharing with Asymmetrically Informed Suppliers
Xia Zhao, Ling Xue, Fuqiang Zhang

Outsourcing firms would usually like suppliers to compete aggressively for the outsourcing contract as supplier competition drives down the prices. Supplier competition, however, is often influenced by the suppliers' knowledge about the cost of service. Both the information management policies of outsourcing firms and the learning capabilities of suppliers may affect the supplier knowledge of service cost. Xia Zhao, Ling Xue, Fuqiang Zhang suggest that when facing competing suppliers with different learning capabilities, outsourcing firms should be careful in managing the information they share with suppliers. First, outsourcing firms should consider providing different information to different suppliers. This helps outsourcing firms maintain information asymmetry between suppliers and benefit from a desirable level of market competition. Second, outsourcing firms should avoid providing too much information to competing suppliers. The information provided may enlarge the knowledge gap between suppliers with different learning capabilities. Consequently, suppliers with lower learning capabilities are likely to be discouraged from competing aggressively and outsourcing firms may suffer from dampened market competition. The conventional wisdom that the client should assist the suppliers with more information gathering to level the playground of competition does not always hold.

Strategic Information Sharing in Competing Channels
Liang Guo, Tian Li, Hongtao Zhang

Despite the emergence of formal sharing processes that automatically transmit raw data from one firm to another along the supply chain, traditional communication devices such as email, phone, fax, and meetings remain dominant. In these informal arrangements, firms decide *ex post* whether to share their information after they see the content of the information. Liang Guo, Tian Li, and Hongtao Zhang examine *ex post* information sharing in a distribution channel between a retailer and a manufacturer and how the information sharing activity is influenced by the presence of a competing channel. It is in the interest of the retailer to disclose only relatively low demand news and withholds high demand news so as to induce a lower wholesale price from the manufacturer. When channel competition is more intense, the retailer should disclose even less information because the retailer now has an additional incentive for withholding high demand news so as to lower the manufacturer's expectation of the retail price in the rival channel. Interestingly, the retailer does not always benefit from an improvement in its information capability even when it comes at no costs. On the other hand, when the rival channel improves its information capability or when channel competition becomes more intense, the retailer should acquire a greater information capability.

With or Without Forecast Sharing: Competition and Credibility under Information Asymmetry
Mehmet Gümüş

Even though forecast sharing among the supply chain parties has been praised in both academic and practitioner literatures, both receiver and sender of the forecast information have concerns that significantly hindered the worldwide adoption and implementation of forecast sharing systems. The receiver is concerned about the credibility of information shared by the sender, whereas the sender is worried that it can be turned into a competitive disadvantage by the receiver. Mehmet Gümüş studies the validity of both concerns. The author finds that contrary to the sender's concerns, the forecast information can indeed intensify the degree of competition among the suppliers (i.e., receivers), which results in lower wholesale prices. On the other hand, the buyer (i.e., sender) can alleviate the suppliers' concerns about the credibility by engaging into quantity commitment contracts with them. Since commitment contracts usually come at a cost for the buyer, the benefit-cost analysis shows that credible forecast sharing can be practically justified only during the later stages of procurement relations between supply chain parties, when they have already somewhat established a relationship. Finally, contract parameters should be customized according to business conditions faced by the parties.

Strategic Sourcing in the Presence of Uncertain Supply and Retail Competition
Jianqing Chen, Zhiling Guo

With the growing trend of outsourcing and globalization, supply uncertainty has become a key factor in crafting a firm's sourcing strategy. Moreover, in today's networked markets, risks resulting from supply uncertainty are often interdependent, leading to the chain effect of demand-side shortage among competing retailers. Jianqing Chen and Zhiling Guo examine the effect of different sourcing strategies on firm performance in the presence of both supply uncertainty and retail competition. Specifically, they consider a supply chain in which a common supplier sells its uncertain supply to a dual-sourcing focal firm and a competing, single-sourcing, rival firm. They

suggest that the focal firm's dual-sourcing strategy can soften the competition and create a win-win situation that leads to increased retail prices and expected profits for both firms. Furthermore, the focal firm might strategically source from the common supplier, even if its alternative supplier offers a lower wholesale price, because doing so can share the scarce supply from the common supplier in the event of supply shortage, thus limiting the competing single-sourcing firm's supply to the market. Overall, the authors identify two types of incentives for adopting the dual-sourcing strategy: the incentive of mitigating supply risk through supplier diversification and the incentive of strategic sourcing for more effective retail competition.

Optimal Inventory Control with Retail Pre-Packs
Long Gao, Douglas J. Thomas, Michael B. Freimer

In retail distribution, a pre-pack is a collection of items bundled together by a supplier or manufacturer. For example, a pre-pack might contain multiple sizes or multiple colors of a particular shirt. When a retail outlet replenishes inventory by ordering pre-packs, rather than single items, distribution and handling costs are typically reduced. This distribution savings comes at a price however, since the ordering flexibility at the retail store is reduced. When pre-packs are available, the retailer must balance the distribution handling savings obtained by using pre-packs with the potential increase in inventory mismatch costs associated with deviating from the ideal target inventory level.

Long Gao, Douglas Thomas, and Michael Freimer develop results characterizing the optimal inventory control policy when a retailer can order both pre-packs and individual items. For the case where the pre-pack contains multiple units of a single item, it is shown that the optimal policy has a band structure, where a retailer should order as few individual units as possible to achieve an inventory position within some band. While characterizing the optimal policy is more complicated when there are multiple items in the pre-pack, it is established that this band structure still holds under certain demand conditions in the multiple item case. These results help reduce the computational burden for finding the optimal policy for general demand. An inventory policy characterized by a band is optimal under certain conditions. Such a policy is likely to work quite well under general demand. Furthermore, the band structure has intuitive appeal and may be easy to implement. Through numerical investigation, the authors show that when the pre-pack handling savings is small relative to the inventory mismatch costs, the band tends to be small. When the reverse is true, and the pre-pack handling savings is large, a retailer is more willing to tolerate larger deviations from the ideal target inventory level. In addition, firms benefit from bundling items that have positively correlated demand since pre-pack orders are more likely to align with realized demand.

Inventory Sharing with Transhipment: Impacts of Demand Distribution Shapes and Setup Costs
Chao Liang, Suresh P. Sethi, Ruixia Shi, Jun Zhang

Integrating the operations of different channels is a key to the success of multi-channel retailers. However, retailers have been using different integration strategies in an ad-hoc fashion with mixed results. Chao Liang, Suresh Sethi, Ruixia Shi and Jun Zhang study a firm's channel integration problem by examining how inventory should be shared among different locations and channels. They find that demand shapes affect a firm's channel integration strategies significantly. Channel symmetry also affects how inventory should be shared among different channels. In particular, when two channels become more asymmetric in their demands, it is sufficient to use one-way transshipment only because the additional value of two-way transshipment is marginal. This implies that a brick-and-click retailer's best channel integration strategy is either store-to-site or site-to-store strategy for inventory sharing when the demand characteristics of the two channels are different.

Integrated Procurement Planning in Multi-division Firms
Anantaram Balakrishnan, Harihara Prasad Natarajan

In the strategically important area of procurement, enterprise integration has enabled multi-division firms to leverage company-wide purchasing power by coordinating the procurement policies across divisions. To take advantage of corporate volume discounts, firms have established corporate procurement organizations that are responsible for developing tactical plans specifying the vendors that each division must use. Such supplier assignment decisions, if based solely on maximizing the vendor discounts, can result in high order management costs for divisions. Motivated by the experience of a large industrial products manufacturer, Anantaram Balakrishnan and Harihara Prasad Natarajan propose a new integrated procurement planning model that incorporates both the firm's annual net purchasing costs, after discounts, and divisional order management costs. This model provides a unifying tactical planning framework for procurement managers. Since the large-scale optimization problem is very difficult to solve using general purpose solvers, the authors develop an advanced polyhedral solution approach based on theoretical results and insights about the structure of

the problem. Computational tests for problems with varying characteristics show that solution method generates near-optimal solutions quickly, and demonstrate that the integrated model can provide significant cost savings compared to autonomous sourcing decisions by individual divisions or using manual decision rules for supplier assignment.

Bounds of Relative Regret Limit in p-Robust Supply Chain Network Design
Junfeng Tian, Jinfeng Yue

Design of a multi-level supply chain network is a classic operations management problem. In 1992, Kouvelis et al. proposed *p*-robust approach, which has become a standard approach in robust supply chain network design. The value of relative regret limit p may significantly influence the supply chain network design. However, all existing *p*-robust design literatures assumed that p is a given arbitrarily value. Junfeng Tian and Jinfeng Yue emphasize the properties of relative regret limit p. The value of p has tight upper and lower bounds. A sequence of supply-chain networks can be designed for different p value between the bounds. A scenario with lower probability and a lower optimal objective function value has a greater chance to achieve relative regret limit p. To focus only on the influence from the relative regret, three additional objective functions are suggested to add into *p*-robust design. The new framework in *p*-robust designs helps to understand the trade-off between the total costs and the relative regret and helps the decision maker to reduce the marketing risks in supply-chain network design.