

Research and Management Insights

Foreword: Special Issue on Retail Operations

Marshall Fisher

Marshall Fisher draws on his field research in the retailing industry to identify the operational challenges faced by retailers, and the relevance of those challenges to senior retail managers and researchers in operations management. He summarizes areas of research in retail operations that have evolved recently and are likely to be important in the future.

Shipping Fees or Shipping Free? A Tale of Two Price Partitioning Strategies in Online Retailing

Mehmet Gümüş, Shanling Li, Wonseok Oh, Saibal Ray

Mehmet Gumus, Shanling Li, Wonseok Oh, and Saibal Ray study price partitioning decisions of online retailers regarding shipping and handling (S&H) fees. Specifically, they analyze two partitioning formats used by retailers. In first scenario, retailers present customers with a price that is partitioned into a product price and a separate S&H surcharge (PS strategy); in the second, customers are offered free shipping through a non-partitioned format where product price already includes shipping cost (ZS strategy). The authors conduct both analytical and empirical analyses, based on product and S&H prices data for two different product categories (digital cameras and printers), to analyze competitive dynamics between these two formats. They establish that PS retailers charge lower product prices than ZS ones, but total price charged is higher for the first group. The S&H charge for PS retailers can be significant - it is, on average, 5.4% (printers) and 3.0% (digital cameras). Retailers which are popular and/or face risky cost environment are more likely to opt for ZS strategy, while retailers whose portfolio includes large or heavy products with high cost (S&H)-to-price ratios usually choose PS strategy. Lastly, this empirical study also illustrates that ZS retailers change their product prices almost 1.5 times more frequently than PS ones.

Selling with Money-Back Guarantees: The Impact on Prices, Quantities, and Retail Profitability

Yalçın Akçay, Tamer Boyacı, Dan Zhang

A “money-back-guaranteed” (MBG) sales policy allows customers to return products that do not meet their expectations back to the retailer for a full or partial refund. Retailers typically either salvage returned products or resell them as open-box items at a discount. Yalçın Akçay, Tamer Boyacı and Dan Zhang develop an analytical model in which the retailer decides on the quantity to procure, the price for new products, the refund amount, as well as the price of returned products when they are sold as open-box, and show that selling with MBGs increases retail sales and profit. The second-sale opportunity created by restocking returned products enables the retailer to generate additional revenues. Offering an MBG without restocking increases the new product price. If the retailer decides to resell the returned items as open-box, the price of the new product further increases while open-box items are sold at a discount. On the other hand, customers enjoy more generous refunds along with lower restocking fees. The opportunity to resell returned products also generally decreases the initial stocking levels of the retailer.

Information-Sensitive Replenishment when Inventory Records are Inaccurate

Adam J. Mersereau

Recent empirical research reveals that retailers' inventory records do not necessarily match the physical inventory on retail shelves. This fact clearly complicates inventory management. Nevertheless, most inventory replenishment policies used in practice are derived assuming inventory positions are known. Adam Mersereau examines how optimal inventory replenishment policies change when a retailer has uncertainty around its inventory position. For example, inaccurate inventory records induce the retailer to increase stocking levels to buffer the additional uncertainty in the matching of supply and demand in the current period. On the other hand, reducing stocking levels can lead to improved information about inventory record inaccuracies that can pay off in the future. These are factors a retailer may consider when designing a replenishment policy in an environment with record inaccuracy. Mersereau also identifies tactical inventory replenishment policies that mitigate the impact of record inaccuracy. While a sophisticated

forward-looking replenishment policy consistently performs best, an intelligent myopic policy strikes an appealing balance between performance and ease of implementation.

The Value of Information for Managing Retail Inventory Remotely

Michael E. Ketzenberg, Neil Geismar, Richard Metters, Erwin van der Laan

In many retail situations, the point of sale is “unattended.” That is, the customer selects from various piles of goods by herself, without any employee involved. The piles of goods are reordered and restocked on a regular schedule by employees, regardless of how many customers have come by. This is common in retail from department stores to grocery stores. This leads to two problems: customers staring at empty bins because the restocking day hasn’t come by yet, or the employee attempting to restock an already full shelf, wasting their time on an unnecessary trip and using too much inventory. However, technology is now available that can change that situation. Technology can remotely monitor inventory to determine when the pile is low enough so that there’s not a stock-out and not a wasted trip taken to stock it. Michael E. Ketzenberg, Neil Geismar, Richard Metters, and Erwin van der Laan look at data capture at these “unattended points of sale” to assess how much more profitable retail can be by adopting this technology. In certain cases, there is virtually no extra profitability, but in other cases it is found that profitability can increase up to 30% using this technology, but companies must be willing to change the way they do business to capture the value. Data is gathered from the retail industry with perhaps the least amount of inventory information: the vending machine industry.

Durability, Transit Lags and Optimality of Inventory Management Decisions

Robert J. Bloomfield, Susan L. Kulp

Despite the consistent introduction of new technologies aimed at improving decision-making, managers continue to make costly, non-optimal decisions, particularly around inventory management. Deviations from optimal ordering behavior lead to more inefficient and ineffective supply chains, resulting in excess inventory, inventory shortages, and excess demand volatility. Much of the previous research focuses on the impact of inter-echelon coordination and information sharing on supply-chain performance. However, few authors investigate how supply-chain characteristics impact performance. Robert J. Bloomfield and Susan Kulp investigate whether and to what extent

inventory durability and transit lags cause managers to deviate from inventory decision optimality. The results indicate that non-optimal decision-making is linked to inventory durability and shipping lags. While both of these characteristics individually impact decision-making, the combination of both characteristics exacerbates the problem greatly. Furthermore, there is no clear psychological explanation for these findings. The results imply that practitioners should pay careful attention to the environmental characteristics of their supply chains and products. For firms trading in durable inventories, it may be easier to reduce transit lags than to train managers to behave optimally in their presence.

RFID-Enabled Visibility and Retail Inventory Record Inaccuracy: Experiments in the Field

Bill C. Hardgrave, John A. Aloysius, Sandeep Goyal

Retailers using Radio Frequency Identification (RFID) to improve inventory visibility in the store continue to expand the product categories tagged. Few retailers envision storewide tagging in the near future and, thus, seek to identify categories to target as a key component of their long-term deployment strategy. Hardgrave, Aloysius, and Goyal investigate characteristics of product categories that show the greatest potential to benefit from RFID tagging. Improved visibility due to RFID tagging is shown to reduce inventory record inaccuracy (IRI) - the bane of retailers due to its detrimental effect on store execution. The study found product categories having high sales velocity, high dollar volume of sales, low cost, high SKU variety, and high product density, showed the greatest improvement. Product categories fitting this profile showed substantial reduction in IRI – ranging from 17% to 82%. Conversely, product categories not fitting the profile showed no significant reduction in IRI. The predictive framework in the paper provides guidance for retailers, who can more efficiently plan a strategy for deploying RFID.

Improving Valuation Under Consumer Search: Implications for Pricing and Profits

Olga Perdikaki, Jayashankar Swaminathan

Improving customer experience is a growing trend in the retail industry and several retailers engage in strategies that increase consumer valuation of their product offerings. Some of these practices include improving the ambience of the store to enhance the presentation of the product category and hiring well trained experts as salespeople to explain the product characteristics. Since such practices are costly and prone to free riding retailers need to carefully

consider the value of investing in them. Perdikaki and Swaminathan investigate the interplay between market characteristics, pricing, and the decision of retailers to adopt such practices. They find that when retailers invest in practices that enhance customer valuation of a product, they price the product in a manner to discourage local customers to buy from the competitor. However, when only one retailer engages in such practices, retailers price to encourage consumer search between them. Furthermore, they show two major effects related to improvements in consumer valuation. First, the authors find that making significant investments in enhancing customer valuation can help a retailer overcome competitive effects. Second, they find that a retailer who does not engage in such practices could benefit from a competitor who has made sufficient investments in enhancing customer valuation.

Sequence Matters: Shelf-Space Allocation under Dynamic Customer-Driven Substitution

Wendell G. Gilland, H. Sebastian Heese

In many retail environments, dynamic substitution between products may occur when customers arrive sequentially and serve themselves from the inventory available on the store shelves. Customers with preference for one product might purchase the other product when their first-choice product is stocked out, so the sequence of customer arrivals affects how product is allocated to customers. An optimal decision regarding stocking levels of each product must consider the likelihood and financial impact of product substitution. A comparison of the performance of the optimal policy with several benchmark policies finds that two policies which consider substitution perform pretty well, with only 1.0% and 2.2% average loss in expected profits vis-à-vis the optimal policy. This suggests that in many settings, considering the sequence of customer arrivals might provide only marginal improvements in profitability. As expected, the naïve policy that allocates shelf space to the two products proportionally to their demands performs much worse, with an average reduction in expected profits of 4.9%, compared to the optimal policy. Studying the sensitivity of the benchmarks' performance with respect to different parameters identifies several scenarios where considering the sequence of customer arrivals can have a substantial impact on expected profits. Wendell Gilland and Sebastian Heese find that using the benchmark policies as heuristics can lead to much worse performance in settings where shelf space is severely constrained, where substitution between products is likely, and where products within a category differ substantially in terms of their unit profitability.

Self Service Operations at Retail Stores: The Role of Inter-Customer Interactions

Mei Li, Thomas Y Choi, Elliot Rabinovich, Aaron Crawford

Fellow customers matter in the design and use of self-service terminals. Mei Li, Thomas Y Choi, Elliot Rabinovich, and Aaron Crawford indicate that at retail self-service terminals, fellow shoppers can exert significant influence onto a focal customer's quality perception and repurchasing intentions. Specifically, pleasant exchanges with fellow shoppers will improve a customer's perception of service quality and repurchasing intentions toward the retailer, even though there is no direct involvement by the retailer in the service creation process. Also, unpleasant exchanges will lower a customer's service quality perception and repurchasing intentions. And this effect appears to be stronger when unpleasant exchanges occur while the customer is using the self-service terminal compared to while he/she waits in line to use the terminal. Further, a customer will blame the retailer for his/her unpleasant exchanges with other shoppers and this blame will reduce his/her service quality perception and intention to purchase from the same retailer. However, the reverse is not true. Even if a customer credits the retailer for a pleasant exchange, this will not increase his/her service quality perception or repurchasing intentions. Managers should view customers' use of self-service terminals as an opportunity to foster shared experiences of collaboration. Retailers should design self-service terminals to make it easy for shoppers to have positive engagements with each other. The incidence of unpleasant inter-customer exchanges during self-service transactions can be reduced by giving customers the choice of using different self-service. It will give customers greater control over how to carry out their self-service encounters and signal a retailer's commitment to meeting customers' preferences.

The Backroom Effect in Retail Operations

Cuneyt Eroglu, Brent D. Williams, Matthew A. Waller

Have you ever asked one of your favorite retailers, "do you have this product in the backroom?" It is common knowledge that retailers often store inventory, not only on the shelf, but also in the backroom. The backroom serves an important purpose by allowing retailers to store excess inventory when it will not fit on the shelf; however, backroom inventory storage increases operational complexity and adds additional costs. Because retailers must consider the effect backroom inventory has on operations, Cuneyt Eroglu, Brent Williams, and Matthew Waller

first derive a method to calculate the expected amount of inventory that must go to the backroom as a result of a lack of space on a retailer's shelf, given a particular order quantity, shelf space allocation, and reorder point. Second, the authors find that by ignoring the "backroom effect" when determining reorder points, retailers will establish artificially high reorder points, leading to increased backroom inventory and subsequently increased total costs.

Analyzing the Efficient Execution of In-Store Logistics Processes in Grocery Retailing – The Case of Dairy Products

Gerald Reiner, Christoph Teller, Herbert Kotzab

The efficient execution of the in-store logistics related to fast-moving, sensitive and essential items is challenging, and crucial for grocery retailers' sales, profits and image. Gerald Reiner, Christoph Teller, and Herbert Kotzab offer insights into the nature of in-store logistics processes related to dairy products in different grocery store formats and to suggest a multi-analysis approach to make the performance of in-store logistics processes measurable, comparable and, consequently, manageable.

Design for the Environment: Life-Cycle Approach Using a Newsvendor Model

Gal Raz, Cheryl T. Druehl, Vered Blass

Gal Raz, Cheryl T. Druehl, and Vered Blass use concepts from both industrial ecology and operations management to study eco-efficient and demand-enhancing product and process eco-innovations for functional and innovative products design choices. Although the per-unit environmental impact always decreases in the manufacturing and use stages, the overall impact across the product's lifecycle may increase due to an increased production quantity. Characterizing the industrial ecology macro concept of decoupling economic growth from environmental impact at the firm level, the authors use manufacturing and use stage environmental impact data from life cycle assessments of functional and innovative products to investigate the conditions under which firm-level growth may occur, while also improving the environmental impacts.

Replacement Decisions for Potentially Hazardous Substances

Tim Kraft, Feryal Erhun, Robert C. Carlson, Dariush Rafinejad

Potentially hazardous substances (e.g., bisphenol-A (BPA) and triclosan) are a major concern for both consumers and corporations. Today, we are still unsure

of the health and environmental impacts for an alarming number of chemicals and substances in commercial use. The EU recognizes this problem and has taken action with the advent of regulation such as REACH. In the U.S., proper regulation for monitoring potentially hazardous substances is still not in place. Without proper regulatory guidance, firms must develop their own policies and strategies for managing the risks associated with a substance. Kraft, Erhun, Carlson, and Rafinejad outline fundamental steps that firms can and should take with respect to potentially hazardous substances. The authors show that as long as a threat of regulation exists, a firm should dedicate some resources towards developing a replacement substance. To determine when to implement a developed replacement, a myopic policy that evaluates the costs and risks of deferring implementation a single period often suffices. Regarding competitive dynamics, the authors find that competition does not necessarily guarantee that firms will be more proactive in their actions. In addition, it can also lead to inefficient outcomes in which firms incur avoidable costs to implement ahead of regulation.

Stock Market Reaction to Green Vehicle Innovation

Sulin Ba, Ling Lei Lisic, Qindong Liu, Jan Stallaert

Sulin Ba, Ling Lei Lisic, Qindong Liu, and Jan Stallaert study the stock market reaction to announcements of global green vehicle innovation over a 14-year time span (1996 to 2009) using the event study methodology. They find that the stock market reacts positively to automakers' announcements of environmental innovation. This is encouraging news for the automobile industry to carry on developing green vehicles, especially at a time when the market demand for green vehicles has not yet achieved a material impact on sales. The authors further investigate the implications of specific green product development decisions. They find that the automakers' choices of innovation type and market segment directly affect their market values. Given the current state of technology development, investors seem to favor incremental green vehicle innovation due to their cost-effectiveness. The stock market also seems to favor green innovation geared toward the higher price, higher quality automobile segment, perhaps because firms can extract a higher profit margin from these green cars. In addition, automakers' profitability matters: the stock market responds more positively to the announcements made by less profitable automakers, possibly because investors expect less-profitable automakers to find a competitive edge through green vehicle innovation. Finally, shareholders react more positively to green vehicle innovation when oil prices increase.

How Does Product Recovery Affect Quality Choice?

Atalay Atasu, Gilvan C. Souza

Atalay Atasu and Gilvan Souza investigate the impact of product recovery (remanufacturing, materials recycling, or a combination) on a firm's choice of design quality for a particular product. Product recovery can be mandated by environmental regulation (such as take-back laws), or economically motivated. The authors show that in general, a product should be designed with a higher quality level if there is recovery of the product at the end of its life. The rationale is—a product with a higher quality can command a higher price, which results in a smaller (but more profitable) customer base, implying lower recovery costs. An exception occurs if recovery is in the form of profitable material recycling, which may induce the firm to lower its product quality and consequently charge a lower price, resulting in a larger customer base that supplies more end-of-life products for profitable recycling. While both consumers and the firm benefit economically from profitable recycling and/or remanufacturing, they are both worse off if recovery is in the form of costly recycling, that is, when recycling is not profitable but mandated by take-back legislation. From an environmental standpoint, product recovery is general beneficial, as it partially closes the production loop, except in some instances of profitable recycling, where higher consumption

may outweigh the environmental benefits of product recovery.

Product Reuse in Innovative Industries

Michael R. Galbreth, Tamer Boyacı, Vedat Verter

Most products require some degree of incremental innovation over time in order to keep up with consumer performance expectations. Given these incremental innovations, which might vary widely across industries, the used products available to an original equipment manufacturer for reuse might not contain identical functionality to newly produced items. Michael R. Galbreth, Tamer Boyacı, and Vedat Verter examine the interaction between the rate of industry innovation and product reuse decisions. Their analysis considers two possible reuse choices – remanufacture to original specifications, or upgrade (at an additional cost) by replacing those components that have experienced incremental innovation since the item was originally produced. Their results demonstrate that the optimal amount of product reuse decreases with the rate of innovation. That is, for firms operating in more innovative industries, the profit maximizing amount of reuse activity will be lower. Furthermore, the authors show how end-of-life costs and the costs of reusable components can be used as levers to encourage more reuse. They also examine the environmental implications of optimal reuse policies in innovative industries.