## Retail Store Stock Inventory Analytics

Literature Survey

Our research agenda on retail store stock Inventory Analytics literature: 1) **Create a Centralized Record of All Products, 2) Identify Stock Location, 3) Do Regular and Accurate Stock Counts, 4) Combine Sales Data With Inventory Data to Simplify Reporting, 5) Create a Purchasing Process, 6) Establish a Process for Markdowns and Promotions, 7) Create a Stock Receiving Procedure, 8) Create a Procedure for Returns, 9) Determine a Dead Stock Procedure, 10) Pick Your Inventory KPIs.**

Retail store execution strategies have attracted the attention of researchers in operations management only recently, but this stream of work is most closely related to our paper. Perhaps the first reference on retail store execution is Salmon (1989) who argued that execution in retailing has become more important than other aspects of retail business (e.g., merchandising). DeHoratius and Raman (2006) analyze the relationship between incentives provided to store managers and monthly sales and shrinkage across a chain of stores. They control for store fixed effects, inventory, and advertising expenditures and, as in our work, find a positive and significant relationship between inventory and sales at the store level. The literature on missing inventory and inventory record inaccuracy in retailing (see Raman et al. 2001a, 2001b) found empirically that, because of execution failures, customers often do not find the products they seek, even if these products are within the store. Raman et al. (2001a, 2001b) report that over 65% of the inventory records at retailer Gamma were inaccurate at the store-SKU level, and that over 16% of the inventory at retailer Beta was missing from the shelf. Their studies report that such issues arise mainly due to store and distribution center replenishment processes, merchandising, inventory management and employee turnover. De Horatius and Raman (2003) outline three approaches to the inaccurate inventory problem: prevention and elimination of root causes (using methods similar to the 5 Ishikawa process of JIT principles), correction and identification of errors through inspection policies, and lastly software solutions that integrate the source of errors into the inventory management system. In a follow-up study, Ton and Raman (2004) find that higher product variety and inventories lead to a higher incidence of phantom stockouts (such that inventory is in the back room but does not reach the shelf) and lost sales. Ton and Huckman (2005) study the impact of employee turnover on process conformance within retail stores and find that the negative effect of turnover is most pronounced in stores with low process conformance (lesser discipline in process execution and adherence to quality standards). Corsten and Green (2003) study the root causes of retail inventory stockouts and point to mechanisms that address the issue of stockouts and improve sales. Van Donselaar et al. (2006) find that store managers systematically made corrections on automated order advices either by shifting orders from peak days to non-peak days or by changing the order size. Fundamentally, this stream of literature has viewed retail operation from the factory lens while omitting the service delivery and customer-employee interaction aspects of retailing. For example, Fisher (2004) argues that both the auto plant and a retail store face a similar execution challenge of making sure what is needed arrives at the right time. Literature on customer satisfaction is voluminous and spans several areas such as marketing, management and accounting. For example, numerous papers use the ACSI (American Customer Satisfaction Index) to study customer satisfaction at the company, industry and macroeconomic levels. For the purposes of our paper, we focus only on customer satisfaction studies that are immediately related to our work in retailing and do not survey the literature that studies the design of satisfaction survey instruments, because in this work we had no control over survey design. The basic tenet of this research stream is that higher service quality improves customer satisfaction, resulting in better financial performance, although the mechanisms by which this improvement happens vary. Iacobucci et al. (1994, 1995) provide precise definitions of service quality versus customer satisfaction. They contend that service quality should not be confused with customer satisfaction, but that satisfaction is a positive outcome of providing good service. Ittner and Larcker (1998) provide empirical evidence at the customer, business-unit and firm- level that various measures of financial performance (including revenue, revenue change, margins, return on sales, market value of equity and current earnings) are positively associated with customer satisfaction. However, in the retail industry they find a negative relationship between satisfaction and profitability which may be because benefits from increased satisfaction can be exceeded by the incremental cost in retail. Sulek et al. (1995) find that customer satisfaction positively affects sales per labor hour at a chain of 46 retail stores. Anderson et al. (2004) find a positive association between customer satisfaction at the company level and Tobin’s q (a long-run measure of financial performance) for department stores and supermarkets. Babakus et al. (2004) link customer satisfaction to product and service quality within retail stores and find that product quality has a 6 significant impact on store-level profits. To summarize, research on customer satisfaction views employees as facilitators of the sales process who are critical to improving the conversion ratio, by providing information to the customers on prices, brands, and product features and by helping customers to navigate store aisles, finding the product and even cross-selling other products. The unique feature of the retail store execution problem is that it combines the factory and the sales components, but this stream of literature focuses only on the latter. Empirical studies of execution span other industries as well. For example, retail banking is dominated by the sales function; Frei and Harker (1999) quantify the inefficiencies in process execution due to process design using Data Envelopment Analysis. Frei et al. (1999) study the impact of the aggregate process performance and process variation on the financial outcome using a sample of 135 bank branches. They report that process variation negatively affects financial performance. Another prominent focus on execution which takes the factory viewpoint is found in the automotive industry. In this context the role of process design and conformance has long been debated, and the virtues of the Toyota Production System are well documented. Womack et al. (1991) show that Toyota’s competitive advantage arises from a combination of employee motivation, training, process designs and JIT techniques. Fisher and Ittner (1999) study the impact of product variety on automotive assembly plant operations and find that increased option content variability in car assembly has an adverse effect on plants’ operational performance, which is manifested in higher total labor hours, overhead hours, downtime hours, rework and inventory levels. MacDuffie et al. (1996) find that parts complexity persistently impairs productivity. Perhaps the closest to retailing are the streams of literatures studying customer satisfaction, operational failures and performance in the airline and healthcare industry, because these industries too combine factory and sales components of execution. Studies of execution in the healthcare industry focused on operational failures in the execution process (Tucker 2004) as well as on learning through these failures (Tucker and Edmondson 2003). Ren and Wang (2006a) empirically link process consistency and service quality while Ren and Wang (2006b) further show how service quality affects volume at US hospitals. Using data on customer complaints caused by operational failures in the airline industry, Lapre and Tsikriktsis (2006) find that customer dissatisfaction follows a U-shaped function of operating experience: first dissatisfaction decreases with experience because airlines learn but then dissatisfaction increases because customers increase their expectations of service. Tsikriktsis (2006) shows that the relationship between operational performance and profitability depends upon a company’s operating model; “focused” airlines show a link between late arrivals and profitability, whereas fullservice airlines do not. Moreover, capacity utilization is a stronger driver of profitability for full-service airlines than for focused airlines. Anderson et al. (2006) find that drivers of customer satisfaction are 7 affected by customer attributions of blame for service failures: namely, customer-employee interactions are less important when the customer attributes blame to the service provider.Decreases Inventory Costs: When you know how much stock you have and how much you need, you can pinpoint inventory levels more accurately, thereby reducing storage and carrying costs for excess merchandise. Other savings include shipping, logistics, depreciation and the opportunity cost that comes from not having an alternative product that might sell better. Minimizes Out-of-Stocks:  
To avoid disappointing customers and missing sales, retailers want to avoid running out of inventory. Retailers can use inventory management tools to determine how much stock is “just right” to have on hand, neither too much nor too little. This amount will be larger for bestsellers than for unpopular products. Also, with real-time information on sales and stock, retailers can react quickly by reordering, transferring stock from another location or drop shipping to the customer.