*Despite ever more demanding retailers and rampant product proliferation, manufacturers have stayed with dangerously indiscriminate production schedules and sourcing strategies. A new approach leaves less money on the table.*

# CONTROL YOUR INVENTORY

## IN A WORLD OF LEAN RETAILING

by Frederick H. Abernathy, John T. Dunlop, Janice H. Hammond, and David Weil

MANUFACTURERS OF CONSUMER GOODS are in the hot seat these days. In the past, retailers would place large orders at the beginning of each selling season, and factories would simply produce to order. But the big chain stores are increasingly adopting lean retailing practices, so they're insisting that manufacturers fill orders to replenish retailers' stock on an ongoing basis. Because factories usually can't produce goods fast enough to meet these orders, manufacturers often hold large inventories for indefinite periods.

And the cost of holding these inventories is only growing. Consumers are demanding greater variety in products, and their preferences are getting harder to predict. As products proliferate and become more susceptible to changing whims, the risk grows that a given product line will have disappointing sales and have to be discounted. But if a manufacturer decides to go lean on inventories, it runs the risk of stockouts, lost sales, and endangered relationships with the chains.

It's a tough position, but a new approach can help manufacturers predict their inventory needs more accurately. Manufacturers tend to treat every stock-keeping unit within a product line the same way – but in fact, these SKUs often have very different levels of demand. By differentiating SKUs according to their actual demand patterns, you can reduce inventories on some SKUs and increase them on others – thereby improving your profitability for the entire line.

Differentiating SKUs can also help you rethink your sourcing strategy. Instead of producing all the SKUs for a product line at a single location, either offshore at low cost or close to market at a higher cost, you can typically do better by going for a mixed allocation. That way, you can meet the demands of retailers while controlling costs and inventory.

## The Inventory Dilemma

To illustrate, let's consider the inventory problems of a hypothetical company called Jeansco. In the 1980s, this blue-jeans manufacturer offered about 1,000 different SKUs – a dozen styles of jeans spread across a few dozen sizes, with total annual sales of 20 million pairs. Each season, Jeansco built up its inventories in preparation for big shipments to retailers. The inventories were enormous just before the shipment date, but the risk was small because all of those jeans matched actual orders retailers had submitted several months before. Inventory, in fact, was just a means of spreading out the demand so factories could achieve a steady, efficient flow of output. For Jeansco, the only cost of inventory lay in the working capital tied up there and in the minor expense of the warehouse. The retailers bore the major cost of inventory – the risk that sales would prove disappointing and the jeans would have to be marked down below cost.

Then in the 1990s, partly to minimize this risk, most of Jeansco's retailers began to adopt lean retailing practices. They shifted most of their ongoing inventories – and risk – back to Jeansco by keeping on-site inventories low and placing weekly replenishment orders. Since the lead time for manufacturing jeans was several weeks, Jeansco could no longer make to order; it now had to predict the weekly demand for jeans and set production schedules accordingly. And even if Jeansco got the average weekly demand right, it also had to take into account those weeks with unusually large orders. To ensure that it could fill those orders and keep its retail customers happy, Jeansco had to estimate the weekly variability in demand and hold a safety stock of finished goods in inventory.

That's difficult enough, but product proliferation only made things worse. In the 1980s, most of Jeansco's 1,000 SKUs garnered fairly high sales. Big volume tended to smooth out the inevitable peaks and valleys of demand. That meant the composite weekly demand was fairly predictable and variability wasn't so great, so the safety stock held in inventories was relatively small.

Today, Jeansco manufactures far more styles and sizes than before – it now offers 30,000 SKUs. And while total annual sales have risen to 90 million pairs, average sales per SKU have fallen from 20,000 units to just 3,000 – or approximately 60 sales per SKU a week, much lower than the 1980 average of 400. And that's just an average. Popular SKUs register hundreds or even thousands of sales per week, but less popular, highly differentiated items may sell only ten across all retail stores. The smaller the volume of sales for any individual SKU, the more those sales tend to vary each week because there is so much less demand to pool together. That means Jeansco has to stock a lot more than ten pairs of those slow-selling jeans to meet sudden upsurges in demand – or risk angering important customers with stockouts. For the same overall level of sales, the company now has to hold a much bigger overall inventory.

> By fine-tuning inventories according to SKU-level demand, a manufacturer can increase profits and reduce inventory risks.

And what happens to Jeansco when certain styles go out of fashion? Retailers stop placing replenishment orders and all those multiple SKUs in inventory have to go to discounters, eating away most of Jeansco's profit. To take an example from the real world, look at what happened recently when demand for athletic shoes suddenly dropped as consumers moved to brown shoes. Nike and its competitors had to take a huge financial hit to dispose of their bulging inventories. In the absence of lean retailing and product proliferation, those losses would have been far smaller.

Product proliferation has transformed retail categories far beyond apparel, from office products to pasta. And the trend isn't going away, despite the fervent wishes of many manufacturers, who complain about erratic orders from retailers. We recently met with an executive who told us business was good, except that low-volume items were causing him fits because retailers kept asking for greatly varying quantities.

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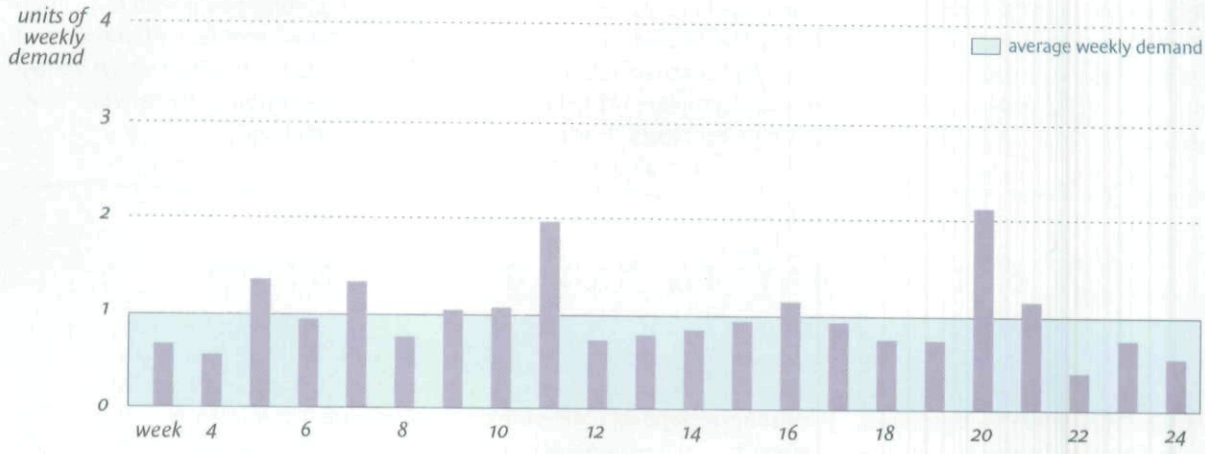
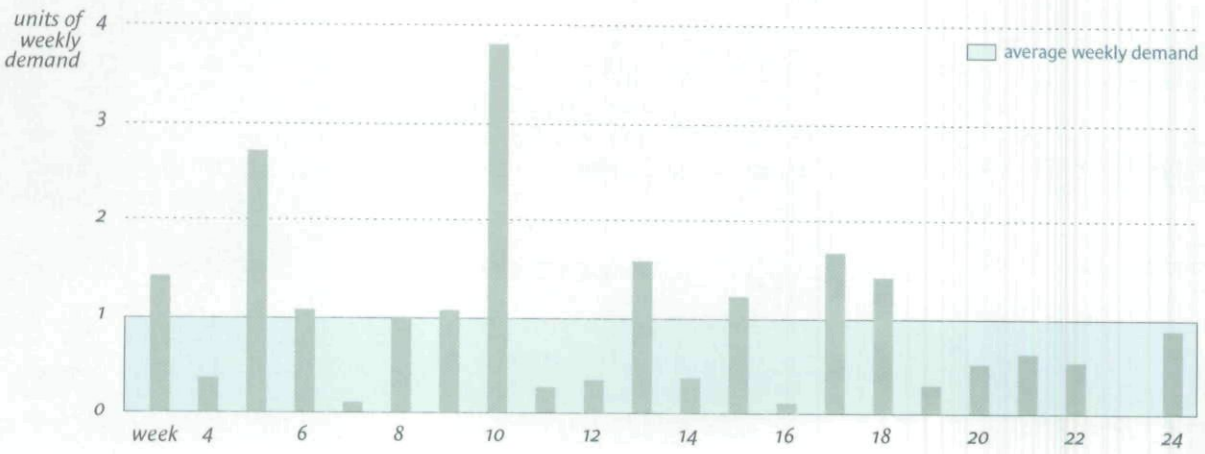
# The Importance of SKU-Level Analysis

The inventory demand for SKUs within the same product line can vary significantly. These charts show the weekly demand across more than a thousand retail outlets for one style of men's blazer in two different sizes. The top chart shows the demand for 46-regular, which is one of the most popular sizes. The bottom does the same for 43-regular, a much slower-selling size. To highlight the variation in demand, we've expressed the sales numbers in units of weekly demand. While 46-regular sells a lot more than 43-regular, those sales are relatively stable – peak sales are only about twice the weekly average. Sales for 3-regular vary a lot more – up to four times the weekly average. As a result, the manufacturer has to keep a much bigger inventory of 43-regular, relative to average weekly sales, than it does for 46-regular. If we were looking at 43-long, the inventory would be bigger still. Although this type of analysis can be done on a simple spreadsheet, manufacturers generally ignore this variation and assign the same inventory targets for all SKUs in the product line.

## *Blazer, Size 46-Regular*




## *Blazer, Size 43-Regular*



"If I could just smooth out that demand," he said, "I'd be fine." Even now, most manufacturers don't think this is their problem to address. Because inventory costs are often hard to measure, losses like Nike's are usually dismissed as special, unpredictable charges. But the long-term negative effect on profit can be substantial.

## Rethinking Your Product Categories

Manufacturers generally classify products in terms of broad product lines, developing a single marketing strategy and production plan for each line. That makes sense for marketing, but it's a mistake for production. Different SKUs within a product line can have very different inventory needs.

Take, for example, a large American manufacturer of men's blazers. As part of our research into lean retailing, we tracked the demand for different sizes of a blue blazer. Far from a trendy fashion item, the blue blazer is a staple of the wardrobes of millions of men. But from the perspective of actual consumer buying patterns, a blazer in an atypical size actually has more in common with a fashion-driven product than with the same style jacket in a popular size. For example, sales for 46-regular, one of the most popular sizes, vary only by twice the average weekly demand, while sales for 43-regular vary as much as four times the average demand. A rare size, such as 43-long, would vary even more. (See the exhibit "The Importance of SKU-Level Analysis.") To satisfy retail customers, the manufacturer must hold a proportionately larger inventory of 43-regular, even though in absolute terms it will hold much more of 46-regular. But most manufacturers, including this one, tend to assign the same inventory policy for all products in a product line.

> While the offshore option remains the most desirable for the lowest-variation SKUs, product proliferation raises the value of the option to produce closer to the market.

By fine-tuning inventories according to SKU-level demand, a manufacturer can increase profits and reduce inventory risks. To demonstrate that improvement, we ran a computer simulation that tests various inventory policies for three groups of SKUs in the same product line – one group with low variance in demand, another with medium variance, and the third with high variance. (See the exhibit "A Better Way to Manage Inventory.")

## A Better Way to Manage Inventory

This table shows the effects of different inventory policies on a set of three SKUs within a product line. The first case focuses on achieving very high order fulfillment for all products to satisfy demanding retailers, but at the cost of high inventories. The second focuses on meeting demand for high-volume products, and the third seeks to maximize profits by balancing the costs of stockouts and inventory. In each of these cases, a single inventory policy is set for all three SKU groups. The fourth case sets inventory policies appropriate for each SKU, maximizing profits while reducing inventory risks.

| | Sales | Production costs | Inventory costs | Average order-fulfillment ratio | Total inventory *weeks of demand* | Profit |
|---|---|---|---|---|---|---|
| 1. Minimize stock outs (Single inventory policy) | $1,761 | $1,198 | $79 | 97% | 18 | $485 |
| 2. Minimize inventory costs (Single inventory policy) | $1,612 | $1,062 | $55 | 89% | 13 | $494 |
| 3. Balance stockout and inventory costs (Single inventory policy) | $1,739 | $1,158 | $70 | 95% | 16 | $512 |
| 4. Maximize profits and reduce inventory risk (SKU-level inventory policy) | $1,728 | $1,148 | $66 | 95% | 15 | $515 |

*dollar amounts are weekly, in thousands*

The first test shows a scenario in which a manufacturer is most concerned about keeping its big retail customers happy by maintaining very high order fulfillment rates. The manufacturer sets a single inventory policy to ensure that its highest variance SKUs have plenty of finished goods on hand – say nine times the expected weekly demand for those SKUs. Following that inventory policy, the other two groups of SKUs in that product line also carry inventory of nine times the expected weekly demand even though their variation is never more than four times the average.

The second test reflects a manufacturer whose concern is maintaining inventories at a level appropriate for its high-volume, low-variability SKUs – say three weeks of demand. That means much lower inventories in general and a savings in working capital and risk. But the trade-off is that the manufacturer frequently runs short on its medium- and especially its high-variability items. That means lost sales and maybe a canceled contract with a prized customer.

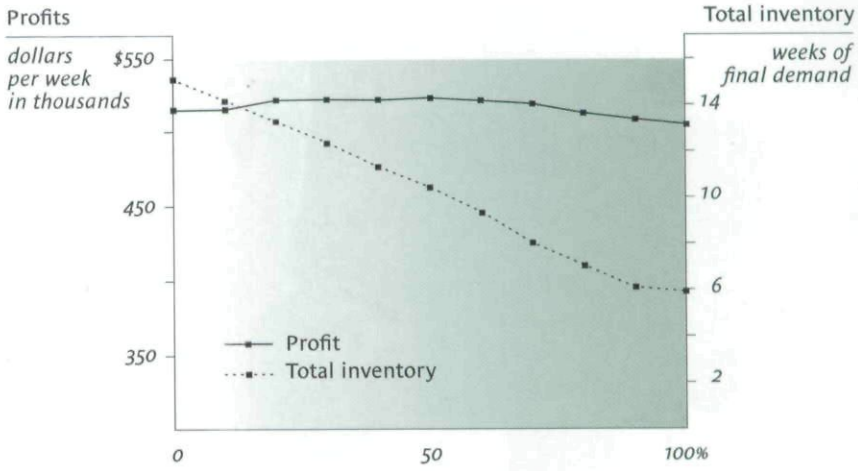
In the third test, the manufacturer focuses on balancing the costs of stockouts and inventory by setting a single inventory policy for all SKUs at seven weeks. In the case of blazers, the inventory of the 43-regular is just about right, but there are too many 46-regulars and stockouts of 43-longs.

The better approach, of course, is for the manufacturer to assign an individual inventory policy for each SKU. The fourth test optimizes the profit of each SKU according to the estimated costs of stocking out versus holding inventory. Inventories for some SKUs go up, while others go down, but overall inventories fall. And net profits rise.

We know of no manufacturers that have fully implemented what we propose. Yet lean retailers like Home Depot and Wal-Mart already incorporate some SKU-level analysis in their own inventory decision making. Calculating SKU-level variation can be done on a simple spreadsheet, so moving toward this type of inventory policy should be quite feasible.

## Sourcing at the SKU Level

*Impact of Short-Cycle Manufacturing on Profits and Inventory*




This graph shows the effects of sourcing decisions on profitability and inventory risk. It simulates the scenario of a manufacturer with two factories: an offshore plant with an 11-week lead time and a higher-cost, short-cycle plant with a two-week lead time. The graph shows how profits (the solid line) and inventory (the dotted line) vary as the manufacturer draws on more production capacity from the short-cycle plant. At one extreme, all production is made at the overseas factory, thereby minimizing production costs. At the other extreme, the short-cycle plant handles everything, thereby minimizing inventory costs. The intermediate values represent a mix of the two facilities, where most of the low-variance SKUs are made offshore and the high-variance SKUs are made at the short-cycle plant. A mixed strategy actually has higher profitability than the 100% offshore option as well as substantially lower inventory costs. The greater the valuation of the inventory risk, the closer the manufacturer will move toward the 100% short-cycle option.

### Rethinking Your Sourcing Strategy

SKU-level analysis has big implications for sourcing as well. For a long time, manufacturers focused on direct costs when they located factories. As a result, many shifted production to developing countries, where labor costs are low. Lately, partly in reaction to the pressures of lean retailing, they've learned the importance of delivering certain goods quickly to the marketplace, so they've moved some production closer to home. In the 1990s, for example, the American apparel manufacturers shifted a full third of the industry's sourcing from Asia to Mexico and the Caribbean. And finally, U.S. manufacturers have experimented with flexible production lines within a factory that allow for fast changeover to make hot-selling lines. But all of these sourcing strategies still tend to treat all SKUs within a product line the same. A better approach would be to move low-volume, high-variance SKUs close to markets, while producing most high-volume, low-variance goods offshore where it is most cost effective.

To set an optimal sourcing policy for a product line, the first step once again is to determine each SKU's variability. Next, arrange the SKUs into groups with similar variations in weekly demand. Each group will have separate inventory policies, and the allocation among different plants will depend on capacity, capabilities, production costs, and lead times for each plant, as well as profit margins.

To simulate this decision, we took the same portfolio of three groups of SKUs as before. The manufacturer has two sourcing options. The offshore facility has low costs but, at 11 weeks, a long lead time for production. The domestic "short-cycle" factory takes only two weeks to bring products to market, but its direct manufacturing costs are 20% higher. The results for this case appear in the exhibit "Sourcing at the SKU Level," which shows how assigning different percentages of total production to the two sources affects profitability and inventory position of the manufacturer.

At one extreme, the manufacturer decides to minimize direct production costs, so it assigns all production offshore. At the other extreme, it uses only the short-cycle line in order to minimize lead time and inventories. The intermediate cases represent a mix of the two facilities, where most of the high variance SKUs are made at the short-cycle plant, while most of the low-variance SKUs go offshore.

Our simulation reveals that the mixed strategy yields the highest profits while still reducing exposure to total inventory risk. The simulation looks explicitly at inventory levels as well as profits, which brings to the forefront both the considerable risk of inventory obsolescence as well as the return on different sourcing strategies. The higher the valuation of inventory risk, the more desirable the short-cycle option becomes. The simulation results show that inventory exposure decreases dramatically as the manufacturer draws more on the short-cycle option. And note that as the number of SKUs increases, so does the demand variability for the manufacturer. While the offshore option remains the most desirable for the lowest-variation SKUs, product proliferation raises the value of the option to produce closer to the market.

In this light, manufacturers would do well to look at their product lines as portfolios of distinct goods. In satisfying the demand of retailers for differentiated products, manufacturers must evaluate the risk that comes with producing the different items in their offerings. By conducting SKU-level analysis, companies can understand the true risks and returns associated with each item, and manage them accordingly.

## Product Proliferation in the Book Industry

**THE BOOK INDUSTRY MAY SEEM A WORLD APART** from other consumer goods. But it illustrates what happens when radical product proliferation – more than 1.2 million individual titles in print – combines with extremely high fixed costs for each batch of production. The weekly demand for an average book, if it could be charted, would vary far beyond anything discussed here. As a result, most manufacturers continue to produce books in big batches, based largely on advance retail orders. But book retailers have begun to adopt many features of lean retailing and also some aspects of SKU-level inventory policies. Manufacturers are likely to follow suit.

To minimize their own inventories, most bookstores offer three kinds of availability to consumers. A hot new book, such as a novel by a major writer, is likely to be stacked high on display tables. But a similar novel by a first-time author may not be. The store will hold only one or two copies of that book. If it runs out of the book, the store can get a copy from the distributor fairly quickly. And what about the previously best-selling novel that everyone's now forgotten? The book is still in print, but the bookstore won't bother keeping any copies on hand. If a customer wants a copy, the store requests one directly from the distributor or publisher, who delivers the book in a few weeks. You can see this type of SKU-level differentiation explicitly at Amazon.com. Books are listed as usually shipping within 24 hours, in two to three days, or in one to two weeks.

As the lean retailing practices of bookstores intensify, distributors and publishers are likely to come under pressure to hold bigger inventories and improve their response to orders. What can they do about it? They can rethink their sourcing strategies. We can see the future in booktech.com, an upstart company that uses digital printing technology. Already popular for customized textbooks and course packets, this printing process is the epitome of flexible manufacturing: it can provide booksellers with rapid replenishment of small orders, but eliminates the need to carry inventories. As production efficiencies for this process continue to improve – and as book publishers work on reducing their own costly inventories – we expect more and more books to be printed this way. Books from major writers will continue to be printed in large batches, but slower-selling books will be printed on demand. As in other industries, this differentiation strategy will allow publishers to meet the needs of retailers while managing exposure to inventory risk.

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