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L.L. Bean, Inc.

Item Forecasting and Inventory Management

"When you order an item from an L.L. Bean catalog and we're out of stock, I'm the guy to blame. And if we end up liquidating a bunch of women's wool cashmere blazers, it's my fault. No one understands how tough it is." Mark Fasold, Vice President—Inventory Management, was describing the challenge of item forecasting at L.L. Bean. "Forecasting demand at the aggregate level is a piece of cake—if we're running short of expectations, we just dip deeper into our customer list and send out some more catalogs. But we have to decide how many chamois shirts and how many chino trousers to buy, and if we're too high on one and too low on the other, it's no solace to know that we were exactly right on the average. Top management understands this in principle, but they are understandably disturbed that errors at the item level are so large.

"In a catalog business like ours, you really capture demand. That's the good news. The bad news is, you learn what a lousy job you're doing trying to match demand with supply. It's not like that in a department store, say, where a customer may come in looking for a dress shirt and lets the display of available shirts generate the demand for a particular item. Or if a customer has some particular item in mind but it's not available, he or she may just walk out of the store. In a department store you never know the real demand or the consequences of understocking. But in our business every sale is generated by a customer demanding a particular item, either by mail or by phone. If we haven't got it, and the customer cancels the order, we know it."

Rol Fessenden, Manager—Inventory Systems, added: "We know that forecast errors are inevitable. Competition, the economy, weather are all factors. But demand at the item level is also affected by customer behavior, which is very hard to predict, or even to explain in retrospect. Every so often some item takes off and becomes a runaway, far exceeding our demand forecasts. Once in a while we can detect the trend early on and, with a cooperative vendor, get more product manufactured in a hurry and chase demand; most of the time, however, the runaways leave us just turning customers away. And for every runaway, there's a dog item that sells way below expectations and that you couldn't even give away to customers."

Annual costs of lost sales and backorders were conservatively estimated to be $11 million; costs associated with having too much of the wrong inventory were an additional $10 million.

This case was prepared by Professor Arthur Schleifer, Jr. as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

L.L. Bean Background

In 1912 Leon Leonwood Bean invented the Maine Hunting Shoe (a combination of lightweight leather uppers and rubber bottoms). He obtained a list of nonresident Maine hunting license holders, prepared a descriptive mail-order circular, set up shop in his brother's basement in Freeport, Maine, and started a nationwide mail-order business. The inauguration of the U.S. Post Office's domestic parcel post service in that year provided a means of delivering orders to customers. When L.L. Bean died in 1967, at the age of 94, sales had reached $4.75 million, his company employed 200 people, and an annual catalog was distributed to a mailing list of 600,000 people.

L.L.'s Golden Rule had been "Sell good merchandise at a reasonable profit, treat your customers like human beings, and they'll always come back for more." When Leon Gorman, L.L.'s grandson, succeeded him as president in 1967, he sought to expand and modernize the business without deviating from his grandfather's Golden Rule. By 1991, L.L. Bean, Inc. was a major cataloger, manufacturer, and retailer in the outdoor sporting specialty field: Catalog sales in 1990 were $528 million, with an additional $71 million in sales from the company's 50,000 square-foot retail store in Freeport. Twenty-two different catalogs (often referred to as "books" by company employees)—114 million pieces in all—were mailed that year. There were six million active customers.

The mail-order business had been giving way to telephone orders after the company installed nationwide "800" service in 1986. By 1991, 80% of all orders came in by telephone.

Major direct-mail competitors included Land's End, Eddie Bauer, Talbot's, and Orvis. A 1991 Consumer Reports survey on customer satisfaction with "mail-order" companies found L.L. Bean heading the list for overall satisfaction in every category for which they offered merchandise.

In explaining why L.L. Bean had not expanded its retail operations beyond the one store in Freeport, Leon Gorman contrasted the direct-marketing (catalog) and retail businesses. "The two approaches require very different kinds of management. Mail-order marketers are very analytic, quantitatively oriented. Retailers have to be creative, promotional, pizzazzy, merchandise-oriented. It's tough to assemble one management team that can handle both functions."[1]

Product Lines

L.L. Bean's product line was classified hierarchically (see **Exhibit 1**). At the highest level of aggregation were Merchandise Groups: men's and women's accessories, men's and women's apparel, men's and women's footwear, camping equipment, etc. Within each Group were Demand Centers; for instance, women's apparel had as Demand Centers knit shirts, sweaters, pants, skirts, jackets and pullovers, etc. Each Demand Center was further broken down into Item Sequences; for example, women's sweaters consisted of Midnight Mesa Handknit Cardigans, Indian Point Pullovers, Lambswool Turtlenecks, and about twenty other products. Item Sequences were further broken down into individual items, distinguished primarily by color; it was at this item level that forecasts had to be issued and, ultimately, purchase commitments had to be made.[2] About 6,000 items appeared in one or another of the catalogs that were issued in the course of a year.

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[1] *L.L. Bean, Inc.: Corporate Strategy*, Harvard Business School Case (581-159), 1981.

[2] Items were further broken down by size into stock-keeping units, or SKUs. This was done by applying standard size-distribution breakdowns. Although an inappropriate distribution could lead to excessive inventory of some sizes and stockouts of others, management concern was directed to the item level, since there was no evidence of a better system than assuming that the distribution of demand by size would behave in the future as it had in the past, and would be indistinguishable from one item to another.

Items were also classified into three seasonal categories (spring, fall, and all year), and into two additional categories ("new" or "never out") that described whether the item was a recent or more permanent member of the company's offerings, and consequently characterized the amount of historical demand data available for the item.

The Bean Catalogs

The major catalogs—spring, summer, fall, and Christmas—each came out in several versions. A "full" catalog, running from 116 to 152 pages, went to Bean's regular customers. A smaller "prospect" catalog was circulated to potential customers; it contained primarily a subset of items from the full catalog. (Bean identified such prospect customers in a variety of ways, for example, through the purchase of mailing lists, or by recording recipients of gifts from other Bean customers.) In addition, a number of specialty catalogs—Spring Weekend, Summer Camp, Fly Fishing, etc.—presented items that were unique to that catalog, as well as some items found in the major catalogs.

There was some overlap in circulation: the best customers received almost all the catalogs, and those customers known, through past purchasing behavior, to be interested in various specialties might receive an appropriate specialty catalog in addition to the seasonal full catalogs.

Item Forecasting

Each catalog had a gestation period of about nine months, and its creation involved merchandising, design, product, and inventory specialists. For example, the initial conceptualization for the Fall, 1991 season began in October, 1990. Preliminary forecasts of total sales for each catalog were made in December. Product managers developed preliminary item forecasts by book in the December, 1990 to March, 1991 time frame. Layout and pagination of the books began in January, 1991. Initial commitments to vendors were made in January and February. In the subsequent months, as the catalogs took shape, item forecasts were repeatedly revised and finally "frozen" by May 1. By early July a black-and-white version of the layout was available internally. At this point, the product managers handed off their product line to the inventory managers.

The completed Fall 1991 catalogs were in the hands of customers around August 1. As the catalog generated demand, inventory managers decided on additional commitments to vendors, scheduled replenishments, handled backorders, etc. This catalog remained active through January, 1992; inventory left over at that time might be liquidated, marked down and sold through special L.L. Bean promotions, or carried over to the next year.

Scott Sklar was a buyer for men's shirts. He described the forecasting process as follows: "Four or five of us—my inventory buyer, some product people, and I—meet to forecast shirt sales by book. We start by ranking various items in terms of expected dollar sales. Then we actually assign dollars in accordance with the ranking. There's discussion, arguments, complaints. People invent rules of thumb. I say 'invent,' because there aren't any good rules of thumb.

"We set this up on an Excel spreadsheet. We look at the book forecast and make adjustments accordingly. We look at the total of forecasted shirt sales and check it for reality. Does it feel good? Does it make sense? We do it book by book, item by item, and that's how we get an item level forecast.

"Of course, when we add a new item, we have to make a judgment: will this item generate incremental demand, and if not, from what items is it going to steal demand? And then those items need to be adjusted accordingly."

Barbara Hamaluk, a buyer for men's knit shirts, observed that the sum of the item forecasts for a catalog was often at variance with the dollar target for that book. "Usually this roll-up comes in on the high side, so you try to reduce forecasts on certain items. Or you can just say, if we're too high by 10%, we'll just slash everything across the board by 10%. We really ought to have an intermediate level of forecasts at the Demand Center level, reconcile item forecasts with Demand Center forecasts, and the latter with the book forecast."

Production Commitments

The typical production lead time for most domestic orders was eight to twelve weeks. (Of course, deliveries against a commitment could be scheduled to conform to the anticipated pattern of in-season demand.) With some vendors who cooperated with L.L. Bean's "Quick Response" initiative, it was possible, after observing some early-season demand, to place a *second* order, which would be delivered in sufficient time to meet late-season demand. However, with many domestic and most offshore vendors, lead times were sufficiently long so that it was impractical to place a second commitment order in the course of the season. (In the remainder of this case, then, discussion will be limited to these "one-shot" commitments.)

The commitments were generally *not* equal in size to the forecasts, but were determined in two steps as follows: First, historical forecast errors (expressed as "A/F ratios" □ the ratio of actual demand to forecast demand) were computed for each item in the previous year, and the frequency distribution of these errors was compiled across items.[3] The frequency distribution of *past* forecast errors was then used as a probability distribution for the as yet unrealized *future* forecast errors. For example, if 50% of the forecast errors for "new" items in the past year had been between 0.7 and 1.6, then it would be assumed that with probability 0.5, the forecast error for any "new" item in the current year also would fall between 0.7 and 1.6. So in such a case, if the frozen forecast for a particular item were 1,000 units, it was then assumed that with probability 0.5, actual demand for that item would end up being between 700 and 1,600 units.

Next, each item's commitment quantity was determined by balancing the individual item's contribution margin if demanded against its liquidation cost (or value) if not demanded. Suppose, for example, that an item cost Bean $15, would regularly sell for $30, and could be sold at liquidation for $10. The gain for selling a marginal unit would be $30 - 15 = $15; the loss for failing to sell the marginal unit would be the cost less the liquidation value, i.e. $15 - 10 = $5. Accordingly, the optimal order size should be the 0.75 fractile of the item's probability distribution of *demand*. Suppose the 0.75 fractile of the distribution of *forecast errors* was 1.3, and the frozen forecast for that item was for 1,000 units. Then the 0.75 fractile of the demand distribution would be 1,000 x 1.3 = 1,300, and Bean would make a commitment for 1,300 units.

Rol Fessenden expressed concern that the methodology treated the errors associated with *all* "never out" items as equally representative of the forecast errors that might be anticipated for the forecast demand of *any* "never out" item (and similarly for "new" items). "You'd think that the error distribution for some of our buyers might be tighter than for other buyers, or that the distribution for women's sweaters might have more dispersion than the distribution for men's footwear, but we can't find any real differences. Also, I'm not entirely convinced that we go about estimating contribution margin and liquidation cost correctly."

Mark Fasold was worried about the wide dispersion in forecast errors, both for "never outs" and "new" items. He was also concerned about the implications of the methodology: "If the cost

[3]This was done separately for "new" items and for "never outs"; not surprisingly, the historical error distribution of "never outs" had less dispersion than that of "new" items. No other way of segmenting items had revealed significantly different distributions of forecast errors.

associated with understocking exceeds the cost of overstocking, which is the usual case here, we end up committing to *more* than the frozen forecast. And for "new" items, about which we obviously know very little, the excess over the frozen forecast is even greater than for "never outs." The buyers are understandably upset when we commit to more than they forecast; they perceive us as going way out on a limb for "new" items."

Exhibit 1