Safety Stock Planning for a Hong Kong Fashion Retailer

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The case is reprinted from
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Introduction and Company Background

Inventory management is a critical part of fashion retail supply chain management. For most fashion products, consumer demand is very difficult to forecast, which makes inventory planning more difficult. In this case analysis, we explore the safety stock management problem in a fashion retailer in Hong Kong. With the (adapted) real data from the company, a systematic analysis on safety stock level can be conducted.

JTMC[2] is one of the well-known chain store fashion retailers in Hong Kong. JTMC currently has 20 retail shops in Hong Kong[3] (each of which carries approximately 400 items), and its annual sales turnover is approximately U.S. $100 million. In addition, it also has an overseas retail network extending to China, Macau, Indonesia, Australia, and many countries in the Middle East, with

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[2] Company JTMC is a fictitious name for a real company.

[3] To keep the company details anonymous, we modified and/or scaled the numbers provided in this case from the real values, but they do show the essential feature of the company and its inventory practice.

a combination of direct operation, franchising, and licensing. The company's objective is to provide its customers with high-quality service and products at a very reasonable price. One of the company's operational philosophies in terms of inventory management is that stock-outs should be avoided as much as possible. To achieve this target, the senior management of the company implements a logistics planning scheme in which (1) the product is replenished every day in a one-to-one replenishment manner (that is, one unit sold today will be filled by a replenishment within one day); and (2) inventory levels should be high and appropriately fill the available display space throughout the year for each in-season item. Thus, for both peak and non-peak seasons, the inventory level (including safety stock) for the same in-season item is the same (if the product is not out of stock, which is also the usual case for JTMC).

Safety Stock Analysis

We have collected a sample of demand data from JTMC (Exhibits 1 and 2) and inventory data (Exhibit 3) for 10 items. With the use of these data sets, we can study quantitatively the appropriate safety stock level with respect to a target inventory service level. We can also comment on the efficiency of the existing inventory planning practice in JTMC.

To conduct the analysis, we make a few assumptions. For the sake of simplicity, we assume the daily demand of each item during each selling season follows a normal distribution. Using the information from Exhibits 1 and 2, we can construct Exhibits 4 and 5, which show the mean and the standard deviation of the daily demand of each item directly.

Because replenishment lead time is fixed (in fact, it is equal to 1), we can employ the standard textbook safety stock formula to calculate

the amount of safety stock needed with a given inventory service target. The specific formula is given here:

$$SS_i^k = \sigma_i^k \sqrt{L}\Phi^{-1}(\alpha)$$

where

- SS_i^k = the amount of required safety stock for item i = 1, 2,..., 10, during season k = *peak, non-peak*.
- σ_i^k = the standard deviation of daily demand for item i = 1, 2,..., 10, during season k = *peak, non-peak*.
- L = the lead time measured in days.
- α = the target inventory service level, which represents the chance of no stock-out during the replenishment cycle (that is, lead time L) and α <100%.
- $\Phi^{-1}(\cdot)$ = the inverse of the standard normal cumulative distribution function (cdf).[4]

With (1), we can calculate the amounts of required safety stock for each item with different inventory service targets. The results are summarized in Exhibits 6 and 7.

With the amount of calculated safety stock as shown in Exhibits 6 and 7, we can establish the inventory level that should be kept for each item with a given inventory service target for each season scenario. In this case study, the inventory level is equal to the mean of daily demand multiplied by the lead time plus the amount of required safety stock, as shown in the following formula:

Inventory level of item i = Mean daily demand of item $i \times L$ + the amount of required safety stock of item i. (2)

Exhibit 8 shows the result.

[4] In Excel, the inverse of the standard normal cdf can be computed by the built-in function "normsinv()." In this case, the numerical analysis is conducted by the Office 2010 version of Microsoft Excel. A different version of Excel might yield slightly different numerical values.