TIM 125/225, LECTURE #8

Agenda

1. HW #4 (work for the coming week)

2. Project

3. From demand forecasting to Inventory Management

4. Cycle Inventory Management

8.1/8
Project

1. Obtain some real demand data from market sizing of similar products.

2. The demand data then needs to be adjusted for the product life cycle.

3. Revise the financial model (from last quarter) to incorporate the new data from Step 2.

4. Use the data from Step 2 to forecast demand for 3-5 years.

3-5 years [time-horizon for your product SCM]
Going from Demand forecasting to Inventory management

Actual demand

Systematic component + Random component

Demand forecasting forecasts the systematic component of demand, aka the expected value of demand, $E(D_t)$

where $D_t$ is the demand at period $t$

$D_{t} \approx 1.25 \times (\text{MAD})_n$

where $(\text{MAD})_n = \frac{1}{n} \left[ \sum_{t=1}^{n} |E_t| \right]$
Forecast \( F_t = E(D_t) \) obtained from the appropriate forecasting method is used as the basis for managing the nominal or average or cycle inventory.

The demand statistics \([E(D_t), \sigma_{D_t}]\) is used as the basis for managing safety inventory.
Cycle Inventory Management

Assumption: Safety inventory or safety stock = 0

\[ Q = \text{quantity (\# of units)} \]

\[ Q_L = \text{lot size = \# of units per shipment from (in this case) supplier to manufacturer} \]

\[ T = \text{replenishment cycle time} \]

Total cost = material or unit cost + shipment or transportation cost + inventory holding cost

\[ C_T = f(Q_L) \]
Problem: What is the optimal value of $Q_L$ that minimizes the annual total cost?

$$\frac{dC_t}{dt} = 0 \Rightarrow Q_L^*$$

Process

1. Determine the annual costs

$$C \triangleq \text{cost for 1 unit (aka material cost)}$$

$$D \triangleq \text{annual demand}$$

Annual material cost, $C_M = DC$
Annual shipment (or transportation costs) \( \{ = C_s \)

\( D \rightarrow \) annual demand

\( Q_L \rightarrow \) qty (shipped) on each shipment

\[
\text{# of shipments per year, } n = \frac{D}{Q_L} \text{ shipments per year}
\]

Cost per shipment = \( S \) (dollars)

Therefore \( C_s = nS = \left( \frac{D}{Q_L} \right) S \)

Annual inventory holding costs \( \{ = C_I \)

\( h \% \rightarrow \% \) holding cost for holding \$1 (100 cents) of inventory for 1 year

If \( h = 20\% \Rightarrow \% \) holding costs = \$0.20 or 20 cents
If \( h \) is the \( \% \) holding cost and \( C \) is the cost of 1 unit, then holding cost per unit = \( hC \)

Average inventory held during the year = \( \frac{Q_L}{2} \)

Therefore the inventory holding cost = \( \left( \frac{Q_L}{2} \right) \times \left( \frac{hC}{\text{inventory}} \right) \)

Redrawn in Lecture #9

Optimal lot size, \( Q_L^* = \sqrt{\frac{2DS}{hC}} \)