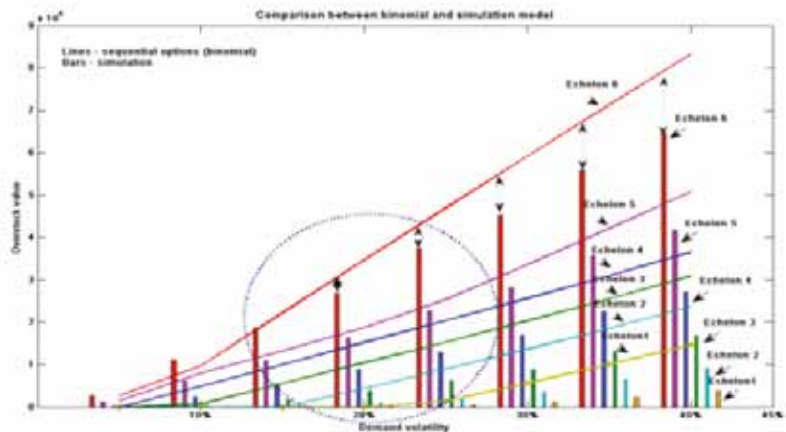


INTEGRATED INVENTORY VALUATION IN MULTI-ECHELON PRODUCTION/DISTRIBUTION SYSTEMS

R. Fernandes, J. B. Gouveia and C. Pinho



Department of Economics,
Management and Industrial
Engineering & GOVCOPP,
University of Aveiro

Supply chains are exposed to different uncertainties that can affect expected service levels. The sources of uncertainty can be linked to capacity availability, inbound resources, or changes in demand.

This study is aimed at the determination of overstock in a multi-echelon supply chain considering the impact of demand uncertainty. In particular, the model intends to answer two practical questions: (1) Can we calculate an integrated and balanced overstock level for a multi-echelon supply chain? (2) What is the impact of demand uncertainty on the upstream echelons of inventory level?

We develop the concept of balanced multi-echelon overstock as a flexible inventory planning technique in uncertain environments. The right level of overstock in a network can be viewed as a series of decision points, where that value consists of two components: one is the value of current echelon overstock; the other is the value of downstream overstock.

At each echelon the manager receives information regarding the overstock in the linked stage, and simultaneously, the manager decides whether to plan an overstock.

1-For high demand uncertainty levels, the overstock increases for all the echelons. This effect is stressed in the downstream nodes (close to the market) and less aggressive in the upstream nodes.

2-A decrease in lead time allows for a lower overstock value for all the echelons. The managerial implication is that efficient practises or agile process designs, able to decrease lead times, can contribute to an overstock decrease.

3-Overstock is more sensible to service level changes in the downstream echelons, where changes in the service

are more expressive and with higher implications. 4-The communication distortion is higher as the distance from the market is amplified. For higher non-optimal overstock values in different echelons, the global overstock value increases.

The purpose and the practical applications of the present study rely on the definition of adequate levels of inventories to hedge against demand uncertainty. When the supply chain has multiple decision echelons at which different stock levels can be applied, it is very important to balance all the buffers depending on uncertainty of market demand and endogenous penetration.

FIGURE 1
Impact on upstream stages of
non optimal overstock values

FIGURE 2
Overstock model (binomial and
simulation) vs demand volatility.

