Chapter 13

Service Levels and Lead Times in Supply Chains: The Order-up-to Inventory Model[1]

Many products are sold over a long time horizon with numerous replenishment opportunities. To draw upon a well-known example, consider the Campbell Soup Company's flagship product, chicken noodle soup. It has a long shelf life and future demand is assured. Hence, if in a particular month Campbell Soup has more chicken noodle soup than it needs, it does not have to dispose of its excess inventory. Instead, Campbell need only wait for its pile of inventory to draw down to a reasonable level. And if Campbell Soup finds itself with less inventory than it desires, its soup factory cooks up another batch. Because obsolescence is not a major concern and Campbell is not limited to a single production run, the newsvendor model (Chapters 11 and 12) is not the right inventory tool for this setting. The right tool for this job is the *order-up-to model.*

Although multiple replenishments are feasible, the order-up-to model still faces the "too little–too much" challenge associated with matching supply and demand. Because soup production takes time (i.e., there is a lead time to complete production), Campbell cannot wait until its inventory draws down to zero to begin production. (You would never let your vehicle's fuel tank go empty before you begin driving to a refueling station!) Hence, production of a batch should begin while there is a sufficient amount of inventory to buffer against uncertain demand while we wait for the batch to finish. Since buffer inventory is not free, the objective with the order-up-to model is to strike a balance between running too lean (which leads to undesirable stockouts, i.e., poor service) and running too fat (which leads to inventory holding costs).

Instead of soup, this chapter applies the order-up-to model to the inventory management of a technologically more sophisticated product: a pacemaker manufactured by Medtronic Inc. We begin with a description of Medtronic's supply chain for pacemakers and then detail the order-up-to model. Next, we consider how to use the model to hit target service

[1] Data in this chapter have been modified to protect confidentiality.