Appendix V: Derating the Service Level to Account for Reduced Periods of Exposure to Stock-outs as a Result of Minimum Buy or Economic Order Quantities

When ordering parts from a supplier under either minimum or economic order size restrictions, with each arrival of a shipment from the supplier we would expect the service level to jump to 100% and then decay as indicated in Fig. 1.

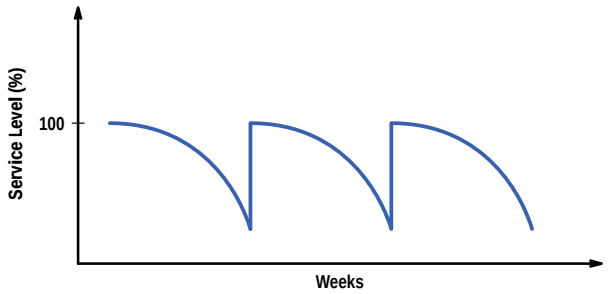

Fig. 1. *The service level jumps to 100% each time a shipment of parts arrives and then gradually decays.*

Since there is realistically only exposure to a stock-out as we approach the anticipated arrival of the next shipment from the supplier, we can afford to run a higher risk of stocking out during these times and still achieve an overall weekly service level objective. The larger the purchase quantity constraints, the less frequent the periods of exposure and, therefore, the lower the service level we can afford at the end of the decay cycle depicted in Fig. 1.

Given that purchase quantity constraints dictate minimum order quantities equivalent to W weeks of expected demand, the objective is to equalize the service level achieved on all parts regardless of the order frequencies. This will be accomplished by basing the service level on a *weekly equivalence*. Given a weekly review period, a weekly desired delivery interval, and no constraints on order sizes, the probability of making it through W weeks without a stock-out is given by:

$$(\text{Weekly Service Level})^{W}.$$

Therefore, if we are ordering in quantities equivalent to W weeks of expected demand, the service level used to determine safety stock should be derated to:

$$(\text{Weekly Service Level Objective})^{W}.$$

Example: We will order in quantities equivalent to four weeks of supply, and we desire a weekly equivalent service level of 99%.

$$\text{Derated Service Level} = (0.99)^{4} = 0.96.$$

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