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Extending the strategic safety stock placement model to consider tactical production smoothing

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Abstract:

We extend strategic safety stock placement models under the guaranteed service approach (GSA) to incorporate tactical production smoothing. We formulate a model to jointly optimize production capacity, production smoothing, and service times between all stages in the supply chain. Analysis of the model leads to several interesting findings. First, for certain service times, production smoothing is desirable to reduce both capacity and inventory costs. Second, inventory cost at a production stage is non-monotonous in its net service time and consequently quoting a large service time may increase costs at both the stage and its customers. Third, safety stocks from a stage can be pooled at a downstream stage only when production is not smoothed, while a smoothed production necessitates safety stocks at the stage. The formulated problem is solved using a dynamic program and numerical experiments on a real-world instance from the literature highlight the value of the proposed model. Through these experiments, we show that integrating production smoothing in GSA models results in considerable savings, especially when capacity costs are neither too high nor too low relative to holding costs. (Joint work with Prof. Tarik Aouam)