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# SUPPLY CHAIN DESIGN: CAPACITY, FLEXIBILITY AND WHOLESALE PRICE STRATEGIES

by

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## **Abstract**

Increasing recognition is being placed, both in industry and in academia, on effective supply chain management. The term supply chain management presupposes that there exists a supply chain to be managed. With a focus on supply chains in which demand uncertainty is the key challenge, this dissertation develops strategies and models to aid in the design of certain supply chain features, namely capacity, flexibility and wholesale price schedules.

Firstly, this dissertation studies capacity investments in single-product supply chains in which the participants make investments to maximize their individual expected profits. Using a stylized game theoretic model of a supply chain comprising a supplier and a manufacturer, simple non-linear wholesale price schedules, whether they be quantity premium or quantity discount schedules, are shown to outperform simple linear schedules in terms of the total supply chain profit achieved. While the model is stylized, it provides insight into how actual wholesale price schedules can be structured to induce near optimal supply chain capacity investments.

Next, this dissertation then extends the work of Jordan and Graves (1995) so as to develop process flexibility strategies for multiple-product multiple-stage supply chains. The ability of multiple-stage supply chains to fill product demands is shown to be affected by two inefficiencies, termed stage-spanning bottlenecks and floating bottlenecks, that do not affect single-stage supply chains. Flexibility configurations differ in the protection they provide against these inefficiencies. The chaining strategy of Jordan and Graves (1995), with augmentation if either the number of stages or number of products is large, is shown to provide a high degree of protection and therefore to enable multiple-stage supply chains to better meet demand.

Finally, this dissertation studies the capacity decision in multiple-product multiple-stage supply chains. Solution approaches to the capacity investment problem in which there is either an expected shortfall bound or a service level bound are developed. The service level problem, while widely studied in inventory theory, has not been studied in the multiple-product multiple-stage supply chain capacity literature to date. In addition to developing solution approaches, insights into the optimal capacity decisions in multiple-product multiple-stage supply chains are provided.

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