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## An Assessment of Supply Chain Disruption Mitigation Strategies

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### ABSTRACT

We assess the effectiveness of incorporating three types of redundancy practices (pre-positioning inventory, backup suppliers, and protected suppliers) into a firm's supply chain that is exposed to two types of risk: supply risk and environmental risk. Supply risk disrupts an individual supplier, while environmental risk makes a number of suppliers in a given region unavailable. An additional factor is supplier interdependence, where a disruption in one supplier may also disrupt other active suppliers. Utilizing the concept of a decision tree to capture different disruption scenarios, we develop a two-stage mixed-integer programming (two-stage MIP) model as a General Model to address the problem of supplier selection and order allocation under supplier dependencies and risk of disruptions. In the General Model, multi-sourcing is the only supplier strategy that the firm implements. Then we develop three separate extensions of the General Model, one for each of the three redundancy practices, and evaluate the expected supply chain cost of each extended model. We quantitatively show how adding redundancy to the supply chain in different forms, along with contingency plans, can help firms mitigate the impact of supply chain disruptions. The findings suggest that all three strategies reduce costs and risks compared to the General Model. An analysis of reliability, risks, dependence, and costs is conducted on each strategy to provide insights into supplier selection, demand allocation, and capability development in a supply chain under supply chain risks. Finally, we show that regionalizing a supply chain is an effective way to mitigate the negative impacts of environmental disruptions on the supply chain.

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