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Choice of an ordering strategy taking account of risks about customer service levels and on-hand inventories*

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Abstract

This paper proposes a methodology to study what ordering strategy will be chosen by companies in a supply chain when risk is taken into account. Here, risks are measured as the standard deviation of the customer service and on-hand inventory levels induced by the three considered strategies. We apply this methodology to investigate the conditions under which optimisation-based and stream management-based strategies are preferred. We find that the considered traditional optimisation-based strategy appears more often in Nash equilibria than any of our two stream management-based strategies. To our knowledge, the methodology itself is one of the first to demonstrate how to take several constraints (market demand, and preferences of companies over customer service and inventory levels) into account when choosing an ordering strategy.

Key words: Game theory, Supply chain management, Decision analysis, Risk analysis, Simulation

1 Introduction

Ordering policies describe decisions at operational level about when and how much to order, while the choice of what ordering policy to use is a tactical or, even, strategical, decision. This operational decision on ordering usually assumes the company alone, while every company is embedded in (at least) one supply chain. Consequently, every placed order not only depends on the state (i.e., inventory level, products currently shipped from suppliers, etc.) and ordering policy of the considered company, but also on the ordering policy and state of the other companies in the supply chain. Therefore, the tactical/strategical decision on what ordering strategy to use must take account of both the internal constraints of the considered company and the constraints imposed by the rest of the supply chain in which this company is embedded. Game theory allows taking such various constraints into account while making such tactical/strategical decisions.

This paper proposes a methodology based on game theory in order to address this tactical/strategical decision of what ordering strategy to choose. Application of game theory to supply chains is far from new – see, for

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