Gaining Benefits from Joint Forecasting and Replenishment Processes: The Case of Auto-Correlated Demand

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In this paper we consider a cooperative, two-level supply chain consisting of a retailer and a supplier. As in many practical settings, the supply chain members progressively observe market signals that enable them to explain future demand. The demand itself evolves according to an auto-regressive time series. We examine three types of supply chain configurations. In the first setting, the retailer and the supplier coordinate their policy parameters in an attempt to minimize systemwide costs, but they do not share their observations of market signals. In the second setting, resembling many original vendor-managed inventory (VMI) programs, the supplier takes the full responsibility of managing the supply chain's inventory, but the retailer's observations of market signals are not transferred to him. In our third setting, reminiscent of collaborative forecasting and replenishment partnerships, inventory is managed centrally, and all demand related information is shared. We propose a set of stylized models to study the three settings and use them to provide managerial insights into the value of information sharing, VMI, and collaborative forecasting.

1. Introduction

In an attempt to streamline their supply chains, companies have engaged in information sharing practices and have established various types of coordination mechanisms. In recent years, electronic data sharing has virtually become an industry standard, and has triggered several important practices such as quick response (QR) (Hammond 1990, Frazier 1986) and efficient consumer response (ECR) (Kurt Salomon Associates 1993). The initial benefits associated with electronic information sharing included the elimination of expensive paperwork and the reduction in human error. With the development of the electronic data interchange (EDI), companies have derived even larger benefits through lead time reduction (due to faster order processing), better visibility into inventory and point-of-sale (POS) data, and through better order tracking systems. For example, Wal-Mart uses EDI as well as the web-based retail link (which connects more than 4,000 suppliers) to allow suppliers to look at POS data to monitor the sales of their products. This, in turn, increases the level of service provided to Wal-Mart's customers due to the ability of the vendors to better plan and execute their business. In recent years, rapid evolution in information technology has paved the way for the implementation of a variety of coordination mechanisms in supply chains, and in many cases it has provided the necessary means for supply chain partners to restructure the way they conduct business. As an example, the reader can refer to Andersen Consulting (1998) for a study of the ways by which companies in the personal computer (PC) industry have integrated their supply chains; see also Magretta (1998) for a discussion of the specific case of Dell Computer.

Consider vendor-managed inventory (VMI), a supply