Chapter 10
Vendor–Buyer Supply Chain Models With Supplier Default Risk Under Selling Price and Trade Credit Period Dependent Demand

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ABSTRACT

This chapter focuses on uncooperative supply chain inventory models when a supplier offers a credit period to the retailer for a fixed period of time. The models are studied with trade credit in Nash game and Supplier-Stackelberg game respectively. First, the authors have presented optimal results for centralized and decentralized decisions with selling price dependent demand and without trade credit. Second, the authors have obtained optimal results under the two games using classical optimization. The total joint profit of the supply chain is maximized with respect to initial lot size, selling price, and trade credit period. Numerical examples are provided to authenticate the proposed model and to provide some managerial insights. Also through sensitivity analysis, important model parameters are examined.

INTRODUCTION

In a competitive market, trade credit finance acts as a promotional tool to stimulate the demand. Trade credit financing alludes to the act of suppliers permitting retailers to place and receive orders without making immediate payment. They don’t charge any interest on the purchase amount within the permissible delay period. On the other hand, the arrangement of allowing trade credit adds extra cost as well as the extra dimension of default risk to a seller.

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Goyal (1985) developed and analyzed the effects of trade credit on the retailer’s ordering policy. Later, Shah (1993) set up a stochastic inventory model under the condition of permissible delay in payments. Aggarwal and Jaggi (1995) extended Goyal’s model (1985) by incorporating the effects of deterioration. They have used exponentially deteriorating items in their model. Teng (2002) amended Goyal’s model (1985) by developing an easy analytical closed-form of the solution. Chang et al. (2003) considered an inventory model for deteriorating items under supplier credits connected to ordering quantity. Alude to survey articles by Chang et al. (2008) and Shah et al. (2010) for available literature on various inventory models under the condition of permissible delay in payments. Min et al. (2010) developed an inventory model with trade credit financing for deteriorating items under stock-dependent demand. Giri and Maiti (2013) developed an inventory model which considers that the retailer obtains a loan from the bank to make payments. They showed that it is more preferable to make payments toward the end of the permissible credit period.

The majority of the references in survey articles are expecting that only supplier is offering a trade credit period to the retailer. Similar to the supplier, if the retailers pass on the trade credit period to his end customers, the demand will raise. Huang (2003) extended Goyal’s model (1985) to an EOQ model in which the vendor offers the retailer a permissible delay in payment (upstream credit period), and retailer thus gives a credit period (downstream credit period) to his end customer. There are many related articles in trade credit financing by Goyal (2007), Liao (2008), Shah and Raykundaliya (2011), Teng et al. (2012), Jaggi et al. (2013), Shah (2015), Shah et al. (2015,2016), Giri et al. (2015) and their references.

In the present market scenario, selling price of a product is a big factor for customers in selecting the item. Whitin (1955) first introduced price dependent demand in his study. Yang and Wee (2006) exhibited a collaborative inventory system for deteriorating items with a price-dependent demand under the effect of permissible delay in payments. They also incorporated negotiation factor to ensure mutual benefits for both the players in the supply chain. Sarmah et al. (2007) considered the issue of coordination and profit sharing with trade credit term in a single vendor and single buyer supply chain system. Shah et al. (2013) developed an inventory model for deteriorating items with a price sensitive demand under the condition of biddable two-part trade credit. Jiang et al. (2014) considered price and stock sensitive demand under permissible delay in payment in their study. Some more related articles with price dependent demand are You (2005), Teng et al. (2005), Maiti et al. (2009), and Shastri et al. (2014).

Kim et al. (1995) described a procedure to achieve an optimal length of the credit period for suppliers in the Supplier-Stackelberg game. Extending work of Kim et al. (1995), Abad and Jaggi (2003) developed an inventory model in which the final demand is sensitive to the selling price charged by the seller and the length of the credit period offered by the seller to the buyer. Teng and Lou (2012) proposed an inventory model which considers trade credit period as a decision variable. Zhou et al. (2012) developed a Supplier-Stackelberg game model with stock-dependent demand with the constraint of limited display-shelf space. They showed that the trade credit policy is always more beneficial to the retailer than to the supplier if it is offered. Chern et al. (2013) derived necessary and sufficient conditions to get an optimal solution for both buyer and vendor under non-cooperative Stackelberg equilibrium. Chern et al. (2014) extended the work of Chern et al. (2013) for vendor-buyer supply chain in Nash equilibrium. They also showed that trade credit has a positive impact on demand but negative impacts on costs and default risks. Recently, Wu and Zhao (2016) discussed a retailer-supplier non-cooperative replenishment models in which demand and default risk are dependent on trade credit. Other recent works in this area include those by Teng et al. (2014), Wang et al. (2014), Dye and Yang (2015), Wu and Zhao (2015), Shah and Cárdenas-Barrón (2015), among others.