Retailer’s Pricing and Lot Sizing Policy for Non Deteriorating Items with Constant Demand Rate Under the Condition of Permissible Delay in Payments

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ABSTRACT

This study develops an EOQ model for retailer’s price and lot size simultaneously when the supplier permits delay in payments for an order of a product whose demand rate is a constant price elastic function for non-deteriorating items. In this study, mathematical models have been discussed under two different situations, i.e., case I: The credit period is less than or equal to cycle time for setting the account; and case II: The credit period is greater than the cycle time for setting the account. Expressions for an inventory system’s net profit are derived for these two cases. The authors develop algorithm for a retailer to determine its optimal price and lot size simultaneously, when supplier offers a permissible in payments.

Keywords: Demand Rate, Inventory, Permissible Delay, Pricing, Replenishments

INTRODUCTION

In practice, a supplier will allow a certain fixed period for setting the amount the retailer owes to him for the items supplied. This fixed period is called credit period. For a supplier who offers trade credit it is an effective means of price discrimination which circumvents antitrust measures and is also an efficient method to stimulate the demand of the product. During the past few decades, many researchers have studied inventory model for deteriorating and non-deteriorating items such as volatile, liquids, medicines, blood bank and fashion goods. The supplier usually expects the profit to increase since rising sales volume can compensate the capital losses incurred during the credit period. The positive effects of credit period on the product demand can be integrated into the EOQ model through the consideration of retailing situations where the demand rate is

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a function of the selling price the retailer sets for the product.

Goyal (1985) developed an EOQ model under conditions of permissible delay in payments. In this EOQ model he ignored the difference between the selling price and the purchase cost, and concluded that the economic replenishment interval and order quantity generally increases marginally under the permissible delay in payments. Goyal’s model is corrected by Dave (1985) by assuming the fact that the selling price is necessarily higher than its purchase price. Recently, Chapman et al. (1985), Goyal (1985) examined the effects of trade credit on the optimal inventory policy with the average cost approach; they reported that the EOQ is invariant to the length of the credit period. This is inconsistent with our expectation since the availability of opportunity to delay the payments reduces the cost of holding inventories, and thus is likely to result in larger order quantity ceteris paribus. This inconsistency caused by the constant demand which is common assumption held by most of the previous research works. Abad (1988) dealt with the retail pricing and lot sizing problem assuming that the supplier offers all-unit quantity discounts and the demand for the product is a decreasing function of price. Abad also extended his model to the case of incremental quantity discounts.

All the research works mentioned assume that inventory is depleted by customer’s demand alone. This assumption is valid for non-deteriorating inventory items. Cohen (1977) analyzed the retailer’s pricing and lot sizing problem for an exponentially deteriorating product. Hark Hwang (1997) obtained retailer’s pricing and lot sizing policy for exponentially deteriorating products under the condition of permissible delay in payments. Aggarwal et al. (1995) developed a model on ordering policies on deteriorating items under permissible delay in payments. Teng (2002) obtained a model on the economic order quantity under the condition of permissible delay in payments.

This study develops an inventory model for retailer’s price and lot size simultaneously for non-deteriorating items when supplier permits delay in payments whose demand rate is constant elastic function. Shortages are not allowed and delay in payment is discussed. Mathematical models are also discussed under two cases, i.e., Case I: The credit period is less than or equal to the cycle time for setting the account and Case II: The credit period is greater than the cycle time for setting the account. Also we obtained, expressions for an inventory system’s net profit for the two cases.

This paper is concerned with the joint price and lot size determination for non-deteriorating product when the supplier permits delay in payments for an order of the product whose demand rate is a constant price elasticity function of retail price. We establish the underlying assumptions. Model formulation is given. We determine the retailer’s pricing and lot sizing policy. We present the general solution of optimal price. An algorithm is given to obtain $P_0$, $P^*$, $T^*$, $Q^*$ and $Z^*$. Finally, concluding remarks and future research are detailed in the last section.

**ASSUMPTIONS**

To develop the model, the following assumptions are being made:

(a) Replenishments are instantaneous with a known and constant lead time.
(b) The demand rate is represented by a constant price elasticity function of retail price.
(c) No shortage is allowed.
(d) The inventory system involves only one item.
(e) The supplier proposes a certain credit period and sales revenue generated during the credit period is deposited in an interest bearing account with rate $I$. At the end of the period, the credit is settled and the retailer starts paying the capital opportunity cost for the items in stock with rate $R (R \geq I)$.
(f) Inventory is depleted only by demand.
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