

Chapter 5

Ordering Policy for Imperfect– Quality Deteriorating Items with Initial–Inspection and Allowable Shortage under the Condition of Permissible Delay in Payments

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ABSTRACT

While developing the inventory model with shortages under permissible delay in payments, it has been observed in the literature that the researchers have not considered the fact that the retailer can earn interest on the revenue generated after fulfilling the outstanding demand as soon as he receives the new consignment at the start of the cycle. Owing to this fact, the present study investigates the impact of interest earned from revenue generated after fulfilling the stock out at the start of the cycle on a single commodity inventory model with shortages for deteriorating item, in which the whole lot goes through an inspection process on arrival before entering into inventory system, under the conditions of permissible delay in payments. After inspection, the non-defective items are retained to fulfill the demand and the defective items are returned to the supplier. The results have been demonstrated with the help of a numerical example using the tools of Matlab7.0.1.

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1. INTRODUCTION

A very common assumption of the economic order quantity is that all the units produced or purchased are of good quality. But practically it is difficult to produce or purchase items with 100% good quality. Thus, the inspection of an ordered lot becomes indispensable in most of the organizations. The inspected items may be classified into two categories viz., non-defective and defective items. After inspection, the non-defective items are retained to fulfill the demand and the defective items are returned to the supplier. The fraction of defective items is constant and deterministic.

However, when the nature of the item is deteriorating then inspection of the lot becomes more important. The deterioration is now a well-established fact, which may take place in the form of gradual decay, damage or perishability and the process is affected by extraneous and invisible factors. Moreover, the deterioration may also happen due to weather conditions, insufficient and unscientific storage structure etc. This situation occurs particularly in case of foodstuffs, which are damaged due to insects, spoilage, and rodents, where as in other commodities deterioration may occur during normal storage facilities. Ghare and Schrader (1963) were the first to propose an economic order quantity (EOQ) model for items with an exponentially decaying inventory. Covert (1973) introduced variable rate of deterioration in Ghare and Schrader (1963) model. A further improvement was introduced by Shah (1977) considering a model allowing complete backlogging of the unsatisfied demand. A good amount of work has been done by different researchers to explore the effect of deterioration on EOQ model under different circumstances (Dave, 1981; K. L. Mark, 1982; Hollier, 1983; Heng, 1991; Raafat, 1991; Widyadana et al., 2011).

Moreover, while developing a mathematical model in inventory control, it is assumed that the payment will be made to the suppliers for the goods immediately after receiving the consignment.

However, in the day-to-day dealing, supplier does allow a certain fixed period to settle the account, during which the supplier charges no interest, but beyond this period interest is charged by the supplier under the terms and conditions agreed upon. Now, in case debt financing, it is often a short-term financing. Thus, interest paid here is nothing but the cost of capital or opportunity cost. Also, short-term loans can be thought of as having been taken from the suppliers on the expiry of the credit period. However, before the account has to be settled, the customer can sell the goods and continues to accumulate revenue and earn interest instead of paying the overdraft that is necessary if the supplier requires settlement of the account after replenishment. Therefore, it makes economic sense for the customer to delay the settlement of the replenishment account up to the last day of the credit period allowed by the supplier. Goyal (1985) presented the model by introducing permissible delay in payments for fixed time period and Aggarwal and Jaggi (1995) extended his work for deteriorating items. Further, Jamal et al. (1997) allowed shortages in the Aggarwal and Jaggi (1995) model, since then, many articles have been appeared under different situations (Raafat 1991; Shah et al. 2000; Goyal and Giri 2001). The primary benefit of taking trade credit is that one can have saving in purchase cost and opportunity cost, which becomes quite relevant for deteriorating items, because in such cases, one has to procure more units than required in the given cycle to account for the deteriorating effect. In particular, when the unit purchase cost is high and decay is continuous, the saving due to delayed payment appears to be more significant.

Lot of work has been published by many authors for finding the economic order quantity with or without shortages for deteriorating items. However, in the literature, it has been found for the inventory models with shortages under permissible delay in payments that the researchers have not incorporated in the interest earned part by the retailer, which he could have also earned

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