Inventory Control With Trade Credit: A Review

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Abstract: This article reviews the literature on quantitatively oriented approaches for determining the optimal economic order quantity when supplier offers credit period to the retailer to settle their account. This survey will be useful for the upcoming researchers in this field.
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1.1. Introduction:

Trade credit is an arrangement that allows firms to buy goods or services without making an immediate payment. It thus allows the separation of the exchange of goods and money over time. It is well recognized that trade credit is likely to be a very expensive source of credit. Trade credit is an important source of finance for firms, especially when firms find it difficult to obtain external funding via credit institutions. Over recent years, trade credit in the form of accounts payable and receivable of euro area non-financial firms has moved broadly in line with the business cycle. Many theories have been put forward to explain the existence of trade credit. Trade credit may be used as a source of funds if raising capital through other sources is more expensive. Price discrimination being illegal in many countries, firms may choose to discriminate between buyers using trade credit. Some firms may choose to make early payments to take advantage of discounts while others may have an incentive to pay towards the end of the credit period. Trade credit may arise as a financial response to variable demand. Trade credit can be seen an outcome of interaction between product and financial markets which arises because it provides the seller with an advantage in inventory management. Sellers can reduce their finished goods inventories by offering trade credit. When business conditions are bad (i.e. inventories pile up) firms may choose to postpone payments for raw materials purchased**. Mehta (21)** applied the statistical technique of sequential decision process to the problems of trade credit management. He tried to examine two problems, i.e. credit extension policy on a specific request or account and construction of indices measuring the effectiveness of such a policy. Trade credit may also enable firms to lower transactions costs.

Peterson and Rajan (24) state, "Trade credit is the single most important source of short-term external finance for firms in the United States." Similar observations have been made about firms in Europe as well **Wilson and Summers (27),** Commonly used credit terms lower a buyer's (retailer's) inventory carrying charges for a limited period of time. If the buyer does not pay in a timely fashion, these terms imply a schedule of escalating finance charge rates **Smith (26).** Reasons that trade credit is popular include (a) the seller has better information about buyers' creditworthiness, (b) the seller can better control a buyer, e.g., by threatening to cut future supplies, (c) the seller incurs smaller transaction costs when salvaging existing assets in case of default, and (d) the seller can, in effect, discriminate on prices.

1.2. Literature survey

Although there is vast literature on inventory models in deterministic and the basic economic order-quantity (EOQ) model**. Haley and Higgins(13), Kingsman(1), Chapman et al.,(2) Daellenbach(11), Ward and Chapman(25), Daellenbach(12) and Chapman and Ward(3)** examined the effect of the trade credit on the optimal inventory policy and studied the relationship between inventory policy and credit policy in the context of the classical lot size model. It is observed that in general, optimality of the total cost of an inventory system requires order quantity and payment time decisions simultaneously. They derived the conditions under which the standard solution reduces to optimal solution. Although these studies provide useful insights into the importance of the credit period in inventory-control decisions, there are some limitations on their analyses. **Chapman et al. (2)** derived an economic order quantity model which considers possible credit periods allowable by suppliers. This model is shown to be very sensitive to the length of the permissible credit period and to the

relationship between the credit period and inventory level. They gave numerical example to show how inventory costs may be considerable reduced by taking the advantage of a credit period into account. In particular, these studies fail to recognize appropriately the effect of the delayed payment in determining the optimal order quantity. As a result, **Haley and Higgins(13), Kingsman,(1) Chapman et al.,(2) Daellenbach(11), Ward and Chapman(25), Daellenbach(12) and Chapman and Ward(3)** argue that as long as the credit periods are fixed, the cost of holding inventory is reduced in comparison with the basic EOQ model, but the optimal order size is the same as that of the basic EOQ model.

EOQ and Trade Credit:

In the classical inventory economic order quantity (or EOQ) model, it was tacitly assumed that the customer must pay for the items as soon as the items are received. However, in practices or when the economy turns sour, the supplier frequently offers its customers a permissible delay in payments to attract new customers who consider it to be a type of price reduction. To motivate faster payment, stimulate more sales, or reduce credit expenses, the supplier also often provides its customers a cash discount. For examples, several years ago, US gas stations adopted a pricing policy that charged less money per gallon to the customer who paid by cash, instead of by a credit card. Likewise, a storeowner in many China towns around the world usually charges a customer 5% more if the customer pays by a credit card, instead of by cash. As a result, the customer must decide which alternative to take when the supplier provides not only a cash discount but also a permissible delay.

Goyal (9) pioneered in developing the mathematical model when supplier announces credit period in settling the account, so that no interest charges are payable from the outstanding amount if the account is settled within the allowable delay period he derived an EOQ model under the conditions of permissible delay in payments The supplier will obviously charge higher interest if the account is not settled by the end of the permissible delay period. In fact, this brings some economic advantage to the system, as retailer would try to earn some interest from the revenue realized during the period of permissible delay. **Shah,et.al (18)** developed a stochastic inventory model when inventory items deteriorate and delay in payment is permissible. **Mandal and Phaujdar (19)** have studied Goyal's model by including interest earned from the sales revenue on the stock remaining beyond the settlement period. **Ouyang et al. (23)** generalized Goyal's model (in which the retailer pays the supplier only the costs when items are sold) to obtain an optimal order policy for the retailer when the supplier offers not only a cash discount but also a permissible delay. **Chung and Huang (6)** extended Goyal's model when replenishment rate is finite. **Chung and Liao (7)** solved the same problem by assuming that the retailer pays the supplier the sales revenue when items are sold. **Hwang,et.al (15)** dealt with the problem of determining the retailer's optimal price and order size simultaneously under the condition of order size dependent delay in payments. It is assumed that the length of the credit period is a function of the retailer's order size and also the demand rate is a function of the selling price. **Huang [15]** discussed a simple method to locate the optimal solution for exponentially deteriorating items when the supplier permits not only a cash discount but also a permissible delay **Chang and Dye (5)** proposed an inventory model for deteriorating items with partial backlogging and permissible delay. **Kreng and Tan (17)** discussed the optimal replenishment decisions under two levels of trade credit policy depend-ing on the order quantity.

Deterioration and trade credit:

Metzler (22) was possibly the first to point out that large firms use trade credit instead of direct price reductions to push sales in periods when monetary conditions were tight. Further, he argued that firms would accumulate liquid balances in periods of loose monetary policy and utilize these to extend trade credit in periods when monetary conditions were tight. These macroeconomic implications of trade credit have been recently further investigated by **Guariglia and Mateut (10)** and **Mateut, Bougheas and Mizen (20)** who conclude that in the UK trade credit increases in periods when monetary policy is tight and bank lending falls.

Lokhandwala et al. (18) extended **Davis and Gaither's (8)** model to determine optimal order quantities for firms where units in an inventory are subject to deterioration at a constant rate, which are offered a one time opportunity to delay payment for an order of a commodity.

To sum up the above article is to bring out a complete and up-to-date review of published articles on trade credit scenario is useful for the researchers of the field of inventory control. This work is very helpful for further study in the field of inventory. We have provided a brief introduction of inventory control with respect to trade credit.

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