行政院國家科學委員會專題研究計劃成果報告

交易信用下的輕型需求者經濟訂購模型分析

An analysis of light buyer's economic order model

under trade credit

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摘 要

貨品需求者的存貨政策與供應商所提供的信用額度及信用期間有密切的關

係。在供應商給定的信用額度及信用期間下，如果需求者的貨品單位時間需求金額（貨品單位時間需求率乘貨品單位價格），使得需求者“可享用信用期間“小於“可享用信用額度所對應的貨品用罄時間“，則稱此需求者為輕型需求者（light buyer）。對一輕型需求者而言，其應如何充分利用無息的交易信用來融資，以決定其最適存貨政策，使其存貨總成本的每年年金約當量，為本研究的重要問題。本文將此問題製作成可以具體討論的數學模式。研究結果顯示：模式的最佳解可由五個財務指標大小關係決定，此項性質可作為營運資金管理者制定營運資金投資與融資政策的重要參考依據。
關鍵詞：輕型需求者，交易信用，信用期間，信用額度，折現現金流量

ABSTRACT

Abstract: Buyer’s inventory policy is related to the credit line and credit period offered by the supplier. A mathematical inventory model of a light buyer is formulated under trade credit and its optimal solution can be determined by five financial indices. On comparing these five financial indices in size, economic order quantity can be decided. Financial managers can make reference to this property when they make the investment and financing policies of working capital.
Keywords: inventory, light buyer, trade credit, discounted cash flow

SOURCE AND PURPOSE

Trade credit is composed of credit period and credit line. The application of trade credit becomes widespread in the development of economy. Trade credit was regarded as a means of a supplier’s marketing strategy. Ashton (1987) points out that trade credit is to lower the effective price of commodity by means of the hidden discount (or called implicit discount). Once a buyer asks for purchasing on credit from the supplier, the supplier will examine the buyer’s credit rating through the credit evaluation process and then the credit line and credit period will be determined. The worse the level is, the less the credit line is and the shorter the credit period is. The buyer will even be asked to pay in cash when his credit rating is very poor. Accordingly, trade credit means implicitly a saving of cost and should be considered in the account of inventory cost.

In practice, the supplier often makes use of credit period and credit line to promote his commodities. But, these two factors are always neglected in a traditional economic order quantity model. In order to expand the application of economic order quantity model, many scholars has been trying to improve the defect of oversimplification. Bregman (1992), Carlson et al. (1996), Chand and Ward (1996) only investigated the influence of the credit period on the economic order quantity. Wilson (1991) just investigated the influence of the credit line on the economic order quantity. Although Goyal (1985) was the exceptional one who considered these two

factors simultaneously in the model, his research results were on the assumption that the buyer's unit capital cost equals to the return rate of investment opportunity. In fact, the supplier gives the buyer different credit line and credit period according to the buyer's credit rating. The credit line was transformed into the length of usable period during which the credit line is in the duration of consumed commodities by the demand amount per unit time (demand quantity per unit time multiplied by unit purchase price). Since usable credit period is not necessarily equal to the length of their usable period in which the credit line is in the duration of consumed commodities, we embedded these characters into the mathematical model to discuss the effects on the economic order quantity in this paper. The view between this paper and the other one is different.

According to the concept of usage rate segmentation, Kolter et al. (1996) point out that suppliers can segment the market into heavy users, light users and nonusers. Those who need a large quantity per unit time are called heavy buyers and those who need a small quantity per unit time are called light buyers. Since buyers have their own specific consumer's behavior, it is necessary for the supplier to receive the response of marketing strategies to the consumer. Generally speaking, light buyers can only passively accept the credit period and the credit line given by the supplier. In this paper, a supplier's light (heavy or regular) buyer is defined as those who needs a small quantity per unit time, which makes their usable credit period shorter (longer or equal to) than the length of their usable period during which the credit line is in the duration of consumed commodities.

We find that there exists a close relationship between the optimal solution and the following five financial indices:

Index 1: Just within the credit period, the perpetuated holding cost per unit differing in future value between continuous compound interest and simple interest is added to purchase price per unit differing in present value between continuous compound interest and simple interest.

Index 2: Just within the credit period, the perpetuated holding cost per unit and discounted purchase price per unit differ in future value between continuous compound interest and simple interest.

Index 3: Just within the period during which the credit line is in the duration of consumed commodities, the perpetuated holding cost per unit and discounted purchase price per unit differ in future value between continuous compound interest and simple interest.

Index 4: Just within the period during which credit line is in the duration of consumed commodities, the perpetuated holding cost per unit and purchase price per unit which differ in future value between continuous compound interest and

simple interest plus interest revenue incurred from the saving of each commodity under the free-financing of credit line.

Index 5: The interest on setup cost is shared by each unit commodity per unit time.

We also can prove that the previous four indices can be arranged in series as the following:

$$Index\,1 \le Index\,2 \le Index\,3 \le Index\,4$$

From a light buyer's standing, this paper examines how he should make his inventory policy properly under trade credit by the concept of discounted cash flow. The results from this research give financial manager a hint at the investment and financing policies of working capital.

RESULT AND DISCUSSION

When the supplier offers credit period and credit line, the buyer will try his best to make use of these free-financing opportunities. For a buyer whose demand quantity per unit time isn't so large that credit line is in the duration of consumed commodities, we define this buyer as a light buyer. Taking a light buyer's standing, how to formulate an optimal inventory policy is always a practical problem in order to minimize inventory cost under the trade credit. Based on these complex situations, one main result of this research is to set up a mathematical model, which can be concretely discussed. Moreover, this research also indicates that the optimal solution to this model can be determined by five financial indices. The research also finds that a close a relationship exists between these five financial indices and economic order quantity. It provides light buyers a hint on how to operate practically. For a policy-maker, no matter what kind of situation he/she faces, he/she can determine economic order quantity from proposition 1 by estimating the five financial indices and comparing them in size. One can make reference to this property when he/she makes the investment and financing policies of working capital.

SELF-EVALUATION

This research completely corresponds to the original plan and has attained its aims. This paper is of great academic values and is suitable for publications in academic journals.

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