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考慮兩階段延遲付款及產品到期日之產品的經濟訂購量模式

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中 文 摘 要 ： 在現今資訊量豐富、交易變動快速且競爭激烈的商業行為中，提供消費者延遲付款的寬限期是廣泛被運用的一種策略。供應商提供允許延遲付款的優惠給零售商(稱為”零售商信用交易期限”)，以鼓勵零售商提高訂貨意願及增加訂購數量；零售商亦可提供允許延遲付款的優惠給顧客(稱為”顧客信用交易期限”)，以刺激買氣，增加消費，提高需求量。然而，零售商若要享受此優惠，往往其訂購數量須達到供應商要求的最低訂購數量。本研究計畫將針對供應商及零售商皆分別提供延遲付款優惠給予各自的購買者，同時，供應商有最低訂購數量的要求下，探討零售商其經濟訂購量，和”顧客信用交易期限”的擬定。本研究計畫假設供應商提供有條件的延遲付款優惠，且產品的需求量為”顧客信用交易期限”的增函數，研究零售商該如何擬訂其訂貨策略和”顧客信用交易期限”，才能使得每年的總利潤達到最大。研究計畫構建數學模式，藉由模式的求解來決定零售商的最佳訂購數量、”顧客信用交易期限”及總利潤。接著，引用數值範例驗證模式的可行性，同時說明訂購策略在管理上的運用及意涵。

中 文 關 鍵 詞 ： 存貨；經濟訂購量；延遲付款

英 文 摘 要 ： In today’s competitive business transaction, the supplier or retailer frequently permits a delay of payment for his/her buyers, in order to encourage his/her buyers to buy more. The supplier offers his/her retailers a permissible delay in payments (say “retailer’s trade credit period”) if the order quantity is large. The retailer also provides his/her customers a permissible delay in payments (say “customer’s trade credit period”). This project will study economic order quantity models for the retailer under two-level trade credit and the retailer’s trade credit period depending on order quantity. We assume that the demand is an increasing function of customer’s trade credit period, in order to reflect the phenomenon that customers will increase their demand if the retailer provides a delay in payments. The purpose of this project is to find the optimal customer’s trade credit period and order quantity for maximizing the retailer’s total profit. The proposed model is illustrated through numerical examples is reported.

英 文 關 鍵 詞 ： Inventory; Economic order quantity; Permissible delay in payments

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Abstract

In today's competitive business transaction, the supplier or retailer frequently permits a delay of payment for his/her buyers, in order to encourage his/her buyers to buy more. The supplier offers his/her retailers a permissible delay in payments (say "retailer's trade credit period") if the order quantity is large. The retailer also provides his/her customers a permissible delay in payments (say "customer's trade credit period"). This project will study economic order quantity models for the retailer under two-level trade credit and the retailer's trade credit period depending on order quantity. We assume that the demand is an increasing function of customer's trade credit period, in order to reflect the phenomenon that customers will increase their demand if the retailer provides a delay in payments. The purpose of this project is to find the optimal customer's trade credit period and order quantity for maximizing the retailer's total profit. The proposed model is illustrated through numerical examples is reported.

1. Introduction

In the traditional inventory economic order quantity (EOQ) model, it is tacitly assumed that the supplier is paid for the items as the items are received.. However, in practice, the supplier may provide a permissible delay to the customer if the total amount is paid within the permitted fixed settlement period. The permissible delay in payments may also be seen as an alternative to a price discount because it does not provoke competitors to reduce their prices, and thus introduces lasting price reductions. Goyal (1985) first derived an EOQ model under the conditions of permissible delay in payments. Aggarwal and Jaggi (1995) then extended Goyal's model to allow for deteriorating items. Next, Jamal et al. (1997) further generalized the model to allow for shortages. Teng (2002) amended Goyal's model by identifying the difference between unit price and unit cost. Ouyang et al. (2006) proposed a general EOQ model with trade credit and partial backlogging for a retailer to determine its optimal shortage interval and replenishment cycle. Goyal et al. (2007) developed an appropriate EOQ model for a retailer where the supplier offers a progressive interest charge. Roy and Samanta (2011) proposed an inventory model with two rates of production for deteriorating items with a permissible delay in payment. Min et al. (2012) established a replenishment model for deteriorating items with trade credit and finite replenishment rate. Yang and Chang (2013) developed a two-warehouse partial backlogging inventory model for deteriorating items with permissible delay in payment under inflation. Tsao (2014) studied a joint location, inventory and preservation decision-making problem for non-instantaneous deteriorating items with delays in payments. There are several interesting and relevant studies related to trade credits, including Ouyang et al. (2005), Sana and Chaudhuri (2008), Chang et al. (2008), Teng (2009), Liang and Zhou (2011), Chern et al. (2013), Ouyang and Chang (2013), Bhunia et al. (2014) Guchhait et al. (2014).

Huang (2003) first established an EOQ model under two levels of trade credit in which the supplier provides the retailer a trade credit period M, and the retailer also offers its customer a trade credit period N (with $N < M$). Teng and Goyal (2007) amended Huang's model and a relaxed dispensable assumption, $N < M$. Jaggi et al. (2008) proposed an EOQ model with credit-linked demand under a permissible delay in payments. Liao (2008) developed an EOQ model with exponentially deteriorating items under two-level trade credit. Thangam and Uthayakumar (2009) extended the model of Jaggi et al. (2008) and developed an EOQ model with selling price and credit-linked demand for deteriorating items. Chang et al. (2010) proposed an EOQ model for exponentially deteriorating items with both upstream and downstream trade credits. Lou and Wang (2013) developed an EOQ model for a manufacturer when its supplier offers an up-stream trade credit, while it, in turn, provides its buyers with a down-stream trade credit. Numerous interesting and relevant papers related to two-level trade credit have been published, including Huang (2007), Teng and Goyal (2007), Ho et al. (2008), Teng and Chang (2009), Teng et al. (2012), Giri and Maiti (2013), Liao et al. (2014).

The aforementioned studies all implicitly assumed the trade credit period offered by suppliers is absolute. However, in reality, a supplier may be willing to offer a permissible delay of payments if a retailer orders a large quantity (which is greater than or equal to a predetermined quantity, say Q_d), in order to encourage the retailer to order more. Further, a supplier does not offer the trade credit period to his/her retailer if the order quantity is less than the predetermined quantity. Chang et al. (2003) established an EOQ model with deteriorating items where a supplier provides a permissible delay of payments for a large order that is greater than or equal to the predetermined quantity. Ouyang et al. (2007) developed an EOQ model for deteriorating items with permissible partial delay in payment linked to order quantity. Teng et al. (2013) proposed an inventory model for increasing demand in a supply chain with upstream and downstream trade credits. Chen et al. (2014) studied a retailer EOQ model where the supplier offers a conditionally permissible delay in payments linked to order quantity. Other studies for trade credit linked to order quantity include Chang (2004), Liao (2007), Chang et al. (2009), and Shah and Cárdenas-Barrón (2015).

Based on the above statements, we establish an EOQ model with credit-dependent demand under a permissible delay in payments linked to order quantity. In this study, we focus on two levels of trade credit - the retailer's trade credit period M and the customer's trade credit period N. We assume the retailer's trade credit is linked to order quantity and the demand is dependent on the customer's trade credit period. The objective of this article is to determine the optimal solutions for the customer's trade credit period, order quantity and replenishment time in order to maximize the total profit of retailer. The optimality conditions are derived to find these solutions. We also provide an efficient algorithm which is implemented as an application with a graphical user interface to quickly obtain the optimal solutions. Finally, using the proposed application, several numerical examples are presented to illustrate the theoretical results and the sensitivity analysis of parameters.

2. Notations and assumptions

The following notations are used throughout this study:

A: The ordering cost per order

c: The purchasing cost per unit

p : The selling price per unit, with $p > c$

h: The unit holding cost per unit time excluding interest charge

I_e: The interest earned per dollar per unit time

I_c : The interest charged per dollar per unit time

M : The retailer's trade credit period offered by the supplier

N : The customer's trade credit period offered by the retailer, where N is a positive integer and decision variable

D : The demand rate per unit time where the demand rate is an increasing function of the customer's trade credit period(N) offered by the retailer; that is, $D = D(N)$, where $D(N) \le D^{\max}$ and $D^{\max}$ is the maximum demand per unit time. For notational simplicity, $D(N)$ and D will be used interchangeably in this article

T : The replenishment cycle time (decision variable)

Q : The order quantity

Q_d : The minimum order quantity for which the delay in payments offered by the supplier is permitted, that is, Q_d is a predetermined quantity

T_d : The time interval in which Q_d units are depleted to zero due to demand

$I(t)$: The level of inventory at time t, $0 \le t \le T$

$TP(T,N)$: the total profit per unit time, which is a function of T and N where the total profit per unit time consists of the (a) sales revenue, (b) cost of purchasing, (c) cost of placing orders, (d) cost of carrying inventory (excluding interest charges), (e) cost of interest charged for unsold items at the initial time or after the permissible delay M and sold items before the customer's trade credit period N, and (f) interest earned from sales revenue during the permissible period interval $[N,M]$(with $N < M$).

In addition, the following assumptions are used throughout this paper:

(1) Shortages are not allowed.

(2) Replenishment is instantaneous.

(3) If the order quantity is less than Q_d, the payment for the items received must be made immediately. That is, the supplier does not offered the trade credit period to the retailer.

(4) If the order quantity is greater than or equal to Q_d, the delay in payments up to M is permitted. During the trade credit period, the account is not settled and the generated sale revenue is deposited in an interest bearing account. At the end of the permissible delay, the retailer pays off all units ordered and starts paying

for the interest charges on the items in stock. The retailer can accumulate revenue in an account and obtain interest earned when $M \geq N$. There is no interest earned for the retailer when $M < N$.

(5) The ending inventory is zero.

3. Mathematical formulations

The inventory level I(t) is depleted due to demand. Hence, the rate of change of inventory can be expressed as

$$\frac{dI(t)}{dt} = -D, \quad 0 \leq t \leq T, \tag{1}$$

with the boundary conditions $I(0) = Q$ and $I(T) = 0$. The solution of (1) can be easily derived as

$$I(t) = D(T - t), \quad 0 \leq t \leq T, \tag{2}$$

and the order quantity is given by

$$Q = DT. \tag{3}$$

From (3), we can obtain the time interval T_d in which Q_d units are depleted to zero due to demand, which can be expressed as

$$Q_d = DT_d. \tag{4}$$

Thus, we know that T_d can be determined uniquely from (4), and the inequality $Q < Q_d$ holds if and only if $T < T_d$.

The total profit per unit time consists of the following elements.

(a) Sales revenue = pD. (5)

(b) Cost of purchasing = cD. (6)

(c) Cost of placing orders = A/T. (7)

(d) Cost of carrying inventory = $h\int_0^T I(t)dt/T = hDT/2$. (8)

Regarding interest charged and earned (i.e. costs of (e) and (f)), there are two cases based on the values of T and T_d, namely Case I: $T < T_d$ and Case II: $T \geq T_d$. The details of the cases are discussed below.

Case I: $T < T_d$

In this case, the order quantity is less than Q_d, and so the delay in payments is not permitted. The total profit per unit time $TP(T,N)$ can be derived as

$$TP_1(T,N) = (p-c)D - \frac{A}{T} - h\frac{DT}{2} - cI_c D(N + \frac{T}{2})$$

$$= (p - c - cI_c N)D - \frac{A}{T} - \frac{(h + cI_c)}{2} DT. \tag{9}$$

Case II: $T \geq T_d$

In this case, the order quantity is not less than Q_d and so the delay in payments is permitted. Based on the values of M, N and $T+N$, there are three possible sub-cases to calculate the interest charged and earned, namely, Sub-case II-1: $T \geq T_d$ and $N \leq M \leq T+N$, Sub-case II-2: $T \geq T_d$ and $N \leq T+N \leq M$, and Sub-case II-3: $T \geq T_d$ and $M \leq N \leq T+N$.

Sub-case II-1: $T \geq T_d$ and $N \leq M \leq T+N$

In this sub-case, the retailer starts getting the money at time N and $N \leq M$. The total profit per unit time $TP(T,N)$ as

$$TP_{2-1}(T,N) = (p-c)D - \frac{A}{T} - h\frac{DT}{2} - \frac{cI_c D}{2T}(T+N-M)^2 + \frac{pI_e D}{2T}(M-N)^2$$

$$= (p - c + cI_c(M-N))D - \frac{(h+cI_c)}{2}DT - \frac{1}{2T}[2A + (cI_c - pI_e)D(M-N)^2]. \tag{10}$$

Sub-case II-2: $T \geq T_d$ and $N \leq T+N \leq M$

In this sub-case, since $M \geq T+N$, the retailer receives the total revenue at time $T+N$, and is able to pay the supplier the total purchasing cost at time M. Hence, the retailer has no interest charged. Therefore, the total profit per unit time $TP(T,N)$ is given as

$$TP_{2-2}(T,N)=(p-c)D-\frac{A}{T}-h\frac{DT}{2}-\frac{pI_eDT}{2}+pI_eD(M-N)$$

$$=(p-c+pI_e(M-N))D-\frac{A}{T}-\frac{(h+pI_e)}{2}DT\ . \tag{11}$$

Sub-case II-3: $T \ge T_d$ and $M \le N \le T+N$

In this sub-case, the customer's trade credit period N is equal to or larger than the retailer's trade credit period M, that is, $M \le N$. There is no interest earned for the retailer. We can obtain the total profit per unit time $TP(T,N)$ as

$$TP_{2-3}(T,N)=(p-c)D-\frac{A}{T}-h\frac{DT}{2}-cI_cD[\frac{T}{2}+(N-M)]$$

$$=[p-c+cI_c(M-N)]D-\frac{A}{T}-\frac{(h+cI_c)DT}{2}\ . \tag{12}$$

4. Optimal solutions

Our objective is to maximize the total profit per unit time $TP(T,N)$, which is a function of the continuous variable T and the discrete variable N. Hence, the problem is to find the optimal values for T and N maximizing $TP(T,N)$. Now, for a fixed value of N, the optimal value of T which maximizes $TP(T,N)$ can be found as follows.

Case I: $T < T_d$

For a fixed value of N, taking the first-order and the second-order derivatives of $TP_1(T,N)$ with respect to T, we obtain the optimal solution is

$$T_1=\sqrt{\frac{2A}{(h+cI_c)D}}\ . \tag{13}$$

Lemma 1: For a fixed value of *N*, let $\Delta_0=T_d^2D(h+cI_c)$. Then, we have the following:

(1) if $2A<\Delta_0$, then $T_1^*=T_1$ is the optimal value which maximizes $TP_1(T,N)$.

(2) if $2A \geq \Delta_0$, then the value of T which maximizes $TP_1(T,N)$ does not exist.

Case II: $T \geq T_d$

In this case, we consider three sub-cases:

Sub-case II-1: $T \geq T_d$ and $N \leq M \leq T+N$

Similarly, we obtain the optimal solution is

$$T_{2-1} = \sqrt{\frac{2A+(cI_c - pI_e)D(M-N)^2}{(h+cI_c)D}}. \tag{14}$$

Lemma 2: For a fixed value of N,

(1) if $T_d > M-N$ and

(a) $2A \geq \Delta_2$, then $T^*_{2-1} = T_{2-1}$ is the optimal value which maximizes $TP_{2-1}(T,N)$.

(b) $2A < \Delta_2$, then $T^*_{2-1} = M-N$ or T_d is the optimal value which maximizes $TP_{2-1}(T,N) = \max\{TP_{2-1}(M-N,N),\ TP_{2-1}(T_d,N)\}$.

(2) if $T_d < M-N$ and

(a) $2A \geq \Delta_1$, then $T^*_{2-1} = T_{2-1}$ is the optimal value which maximizes $TP_{2-1}(T,N)$.

(b) $2A < \Delta_1$, then $T^*_{2-1} = M-N$ or T_d is the optimal value which maximizes $TP_{2-1}(T,N) = \max\{TP_{2-1}(M-N,N),\ TP_{2-1}(T_d,N)\}$.

(3) if $T_d = M-N$ and

(a) $2A \geq \Delta_2 (= \Delta_1)$, then $T^*_{2-1} = T_{2-1}$ is the optimal value which maximizes $TP_{2-1}(T,N)$.

(b) $2A < \Delta_2 (= \Delta_1)$, then $T^*_{2-1} = T_d$ ($= M-N$) is the optimal value which maximizes $TP_{2-1}(T,N)$.

Sub-case II-2: $T \geq T_d$ and $N \leq T+N \leq M$

Similarly, we obtain the optimal solution is

$$T_{2-2} = \sqrt{\frac{2A}{(h+pI_e)D}}. \tag{15}$$

Lemma 3: For a fixed value of *N*,

(1) if $T_d < M - N$, then $T_{2-2}^* = T_{2-2}$ is the optimal value which maximizes $TP_{2-2}(T,N)$.

(2) if $T_d = M - N$, then $T_{2-2}^* = T_d = M - N$ is the optimal value which maximizes $TP_{2-2}(T,N)$.

Note that it is a contradictory case when $T_d > M - N$.

Sub-case II-3: $T \geq T_d$ and $M \leq N \leq T + N$

Similarly, we obtain the optimal solution is

$$T_{2-3} = \sqrt{\frac{2A}{(h + cI_c)D}}. \tag{16}$$

Lemma 4: For a fixed value of *N*,

(1) if $2A \geq \Delta_0$, then $T_{2-3}^* = T_{2-3}$ is the optimal value which maximizes $TP_{2-3}(T,N)$.

(2) if $2A < \Delta_0$, then $T_{2-3}^* = T_d$ is the optimal value which maximizes $TP_{2-3}(T,N)$.

Using the above lemmas, for a fixed value of N, we obtain the following theorems.

Theorem 1: For a fixed value of *N*, if $M > N$, $T_d > M - N$ and $cI_c > pI_e$, then $\Delta_0 > \Delta_1$ and the following results are obtained.

(1) If $2A \geq \Delta_0$, then $TP^*(T^*, N) = TP_{2-1}(T_{2-1}, N)$.

(2) If $\Delta_2 < 2A < \Delta_0$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_{2-1}, N),\ TP_1(T_1, N) \}$.

(3) If $2A \leq \Delta_2$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_d, N),\ TP_{2-1}(M - N, N),\ TP_1(T_1, N) \}$.

Proof. It immediately follows from Lemma 1 and Lemma 2-(1).

Theorem 2: For a fixed value of *N*, if $M > N$, $T_d > M - N$ and $cI_c \leq pI_e$, then $\Delta_0 < \Delta_1$ and the following results are obtained.

(a) For $\Delta_2 < \Delta_0 < \Delta_1$, and

(1) if $2A \geq \Delta_0$, then $TP^*(T^*, N) = TP_{2-1}(T_{2-1}, N)$.

(2) if $\Delta_2 < 2A < \Delta_0$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_{2-1}, N),\ TP_1(T_1, N) \}$.

(3) if $2A \leq \Delta_2$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_d, N),\ TP_{2-1}(M-N, N),\ TP_1(T_1, N) \}$.

(b) For $\Delta_0 < \Delta_2 < \Delta_1$, and

(1) if $2A \geq \Delta_2$, then $TP^*(T^*, N) = TP_{2-1}(T_{2-1}, N)$.

(2) if $\Delta_0 < 2A < \Delta_2$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_d, N),\ TP_{2-1}(M-N, N) \}$.

(3) if $2A \leq \Delta_0$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_d, N),\ TP_{2-1}(M-N, N),\ TP_1(T_1, N) \}$.

Proof. It immediately follows from Lemma 1 and Lemma 2-(1).

Theorem 3: For a fixed value of *N*, if $M > N$ and $T_d < M - N$, then $\Delta_2 (= \Delta_4) > \Delta_3$ and the following results are obtained.

(1). If $2A \geq \Delta_1$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_{2-1}, N),\ TP_{2-2}(T_{2-2}, N) \}$.

(2). If $2A < \Delta_1$, then $TP^*(T^*, N) = \max\{ TP_{2-1}(T_d, N),\ TP_{2-1}(M-N, N),\ TP_{2-2}(T_{2-2}, N) \}$.

Proof. It immediately follows from Lemma 2-(2) and Lemma 3-(1).

Theorem 4: For a fixed value of *N*, if $M > N$ and $T_d = M - N$, then $TP_{2-1}(T_d, N) = TP_{2-2}(T_d, N) = TP_{2-1}(M-N, N) = TP_{2-2}(M-N, N)$, $\Delta_1 = \Delta_2 = \Delta_3 = \Delta_4$ and the following results are obtained.

(1). If $2A \geq \Delta_1$, then $TP^*(T^*, N) = TP_{2-1}(T_{2-1}, N)$.

(2). If $2A < \Delta_1$, then $TP^*(T^*, N) = TP_{2-1}(T_d, N)$.

Proof. It immediately follows from Lemma 2-(3) and Lemma 3-(2).

Theorem 5: For a fixed value of *N*, if $M \leq N$, the following results are obtained.

(1). If $2A \geq \Delta_0$, then $TP^*(T^*, N) = TP_{2-3}(T_{2-3}, N)$.

(2). If $2A < \Delta_0$, then $TP^*(T^*, N) = \max\{ TP_{2-3}(T_d, N),\ TP_1(T_1, N) \}$.

Proof. It immediately follows from Lemma 1 and Lemma 4.

5. Numerical Examples

Example 1: Let $D = D(N) = \alpha + \beta N^r$, where $\alpha = D(0)$ is the initial demand per unit time, and β and r are the customer's trade credit period (N) sensitive parameters of demand. Consider α = 80 units/day, β = 30, r = 0.12, A = \$1000/order, M = 30 days, h = \$4.5/unit/year, c = \$28/unit, p = \$45/unit, I_e = 0.10 per year, I_c = 0.15 per year, Q_d = 2000 units/order, and $D^{\max} = 150$ units/day.

The optimal solution obtained is: optimal replenishment cycle T^* = T_{2-3} = 25.45 days, optimal order quantity Q^* = 3296.47 units, optimal customer's trade credit period N^* = 65days, and optimal total profit per day $TP^*(T^*, N^*)$ = \$2070.90.

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科技部補助計畫衍生研發成果推廣資料表

日期:2016/11/18

<table>
<tr><td rowspan="3">科技部補助計畫</td><td>計畫名稱: 考慮兩階段延遲付款及產品到期日之產品的經濟訂購量模式</td></tr>
<tr><td>計畫主持人: 張春桃</td></tr>
<tr><td>計畫編號: 104-2410-H-032-045- 學門領域: 作業研究／數量方法</td></tr>
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104年度專題研究計畫成果彙整表

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（說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等）</td></tr>
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2.2016智慧科技與應用統計研討會,2016.5.28.</td></tr>
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		著作權	0		
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參與計畫人力	本國籍	大專生	0	人次	
		碩士生	2		
		博士生	0		
		博士後研究員	0		
		專任助理	0		
	非本國籍	大專生	0		
		碩士生	0		
		博士生	0		
		博士後研究員	0		
		專任助理	0		
其他成果 （無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）					

科技部補助專題研究計畫成果自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現（簡要敘述成果是否具有政策應用參考價值及具影響公共利益之重大發現）或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估
   ■達成目標
   □未達成目標（請說明，以100字為限）
   　　□實驗失敗
   　　□因故實驗中斷
   　　□其他原因
   說明：

2. 研究成果在學術期刊發表或申請專利等情形（請於其他欄註明專利及技轉之證號、合約、申請及洽談等詳細資訊）
   論文：□已發表　■未發表之文稿　□撰寫中　□無
   專利：□已獲得　□申請中　■無
   技轉：□已技轉　□洽談中　■無
   其他：（以200字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性，以500字為限）
   研究計畫構建數學模式，藉由模式的求解來決定零售商的最佳訂購數量、”顧客信用交易期限”及總利潤。引用數值範例驗證模式的可行性，同時說明訂購策略在管理上的運用及意涵。

4. 主要發現
   本研究具有政策應用參考價值：■否　□是，建議提供機關
   （勾選「是」者，請列舉建議可提供施政參考之業務主管機關）
   本研究具影響公共利益之重大發現：■否　□是
   說明：（以150字為限）