Retailer’s optimal credit and replenishment policy for deteriorating items with credit linked demand in a supply chain

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Abstract: It has been generally observed that the credit period has become a major concern for most of retailers, as it not only has direct influence on inventory and finance, but also on the demand of an item. Unfortunately, for deteriorating items, the impact of the credit period on demand has not received much attention in the literature, whereas in reality, the length of the credit period offered by the supplier/retailer has a positive impact on the demand rate. Furthermore, it is generally observed that at the initial stage the credit period may not be effective in realising the demand but as the credit period increases it has a significant impact on demand and gradually reaches its saturation level. In order to incorporate this phenomenon in a supply chain of a single supplier single retailer and multiple consumers, a credit-linked demand function has been considered to determine the optimal replenishment time as well as the credit period for a retailer. Using the theorem, the optimal replenishment policy for deteriorating items has been derived for the retailer. Finally, results have been validated with numerical examples followed by a sensitivity analysis.

Keywords: inventory; credit-linked demand; delay in payments; two level credit policies; deterioration.


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1 Introduction

The economic order quantity (EOQ) model is a simple mathematical model to deal with inventory management issues in any inventory system. It is considered to be one of the most popular inventory control models used in industry. However, this model works under very restricted conditions. One such condition is where the product can be stored for a large amount of time. In general, almost all products deteriorate over time. At times the rate of deterioration is so low, that it does not have any impact on EOQ. However, there exists a large list of items, such as, blood, fish, strawberry, alcohol, gasoline, radioactive chemicals, medicine and food grains that deteriorate rapidly over time. Therefore, its impact on the decision-making process cannot be ignored. The first attempt to describe optimal policies for deteriorating items was made by Ghare and Schrader (1963) who derived a revised form of the EOQ model assuming exponential decay. Furthermore, Covert and Philip (1973) developed an EOQ model with Weibull distribution deterioration. Misra (1975) considered an economic production quantity (EPQ) model for deteriorating items with both a varying and a constant rate of deterioration. Later, Balkhi and Benkherouf (1996) proposed a method for obtaining an optimal production cycle time of deteriorating items in a model where demand and production rates are functions of time. There are several other interesting papers related to deterioration viz. Dave and Patel (1981), Hollier and Mark (1983), Chung and Ting (1994), Hargia and Benkherouf (1994) Hargia (1995), Samanta and Roy (2004) and many more.

Trade credit is also a key concern for many enterprises, which has a clear impact on inventory and finance. Trade credit can either be of one or of two levels. Inventory models having one level of trade credit are those in which the supplier offers a credit period to the retailer for making the payment but the retailer does not offer any credit period to his customers. Goyal (1985) first developed an EOQ model under the conditions of permissible delay in payments. Chung (1998) then developed an alternative approach to the problem. Chand and Ward (1987) analysed Goyal’s problem under assumptions of the classical EOQ model and obtained different results. Aggarwal and Jaggi (1995), Chu et al. (1998), Chung et al. (2001), Hwang and Shinn (1997) and Shinn et al. (1996) extended Goyal’s model to accommodate more real situations of deterioration of units in an inventory system. Chung (2000) obtained an alternative method to modify Shah’s (1993) solution. Jamal et al. (1997) extended Aggarwal and Jaggi’s (1995) model by allowing shortages. Subsequently, Jaggi and Aggarwal (1994)
developed a model for credit financing in economic ordering policies of deteriorating items. Relevant papers related to the delay of payments are easily available. The review article by Chang et al. (2007) gives a complete and up-to-date survey of the published inventory literature under trade credits.

In two levels of trade credit, both the supplier as well as the retailer offers the credit period to their respective customers. Huang (2003) presented an inventory model assuming that the retailer also offers a credit period to his/her customer which is shorter than the credit period offered by the supplier, in order to stimulate the demand. Later, Huang (2007) expanded the same inventory model within the EPQ framework. Recently, Ho et al. (2008) formulated an integrated supplier-buyer inventory model with the assumption that the market demand is sensitive to the retail price and the supplier adopts a trade credit policy to determine the optimal pricing, shipment and payment policy.

Moreover, trade credit also has impact on the demand of the item. But, unfortunately, this area has not been explored up-to its potential. Recently, Jaggi et al. (2008) made an attempt to develop an inventory model for non-deteriorating items with credit-linked demand under permissible delay in payments. Jaggi and Kausar (2009) extended the model for the case of deteriorating items. They considered the impact of credit on demand to be instantaneous, which is not always true. It is generally observed that at the initial stage the credit period may not be effective in realising the demand but as the credit period increases it has a significant impact on demand and gradually reaches its saturation level. As the deteriorating items have got a much shorter life so it is desired to stimulate the demand of such items so that the loss due to deterioration can be reduced. In order to incorporate this phenomenon in a supply chain of single supplier single retailer and multiple consumers, for deteriorating items, a credit-linked demand function has been considered for determining the optimal replenishment time as well as the credit period for a retailer. These types of demand functions are observed in many consumer durables.

2 Assumptions and notations

The following assumptions are made to develop the mathematical model:

1. the demand rate is a function of the credit-period offered by the retailer \((N)\)
2. the supplier provides a fixed credit period \(M\) to settle the accounts to the retailer and the retailer, in turn, also offers a credit period \(N\) to each of its customers to settle the accounts
3. replenishment rate is infinite
4. shortages are not allowed
5. lead-time is negligible
6. a constant fraction of the on-hand inventory deteriorates per unit time
7. there is no repair or replenishment of the deteriorated items during the inventory cycle.
In addition, following notations are used:

\( D(N) \) the demand rate, function of the customer’s credit period

\( Q \) order quantity

\( T \) inventory cycle length

\( q(t) \) the inventory level at time \( t \)

\( \theta \) deterioration rate per unit time (\( 0 \leq \theta \leq 1 \))

\( A \) ordering cost per order

\( C \) unit purchase price of the item

\( P \) unit selling price of the item

\( S \) maximum demand rate

\( r(N) \) rate of change of demand

\( I \) inventory carrying charge per $ per unit time (excluding interest)

\( I_c \) interest rate that can be earned

\( I_p \) interest rate payable per $ per unit time

\( M \) retailer’s credit period offered by the supplier

\( N \) customer’s credit period offered by the retailer

\( Z(T, N) \) retailer’s profit per unit time.

### 3 Mathematical formulation

The demand rate is a function of the credit-period offered by the retailer \( N \). It is assumed that the marginal effect of the credit period on sales is proportional to the unrealised potential of the market demand without any delay; the demand function can be represented as a differential difference equation

\[
D(N + 1) - D(N) = r(N)[S - D(N)]
\]  

where

\[
r(N) = r^2 N / (1 + rN) \text{ (It can be estimated using the past data)}
\]  

It is assumed here that \( r(N) \) is an increasing function in \( N \) that reaches \( r \) as \( N \) approaches infinity.

The solution of the above difference equation is derived using a probability generating function, under the condition that at \( N = 0, D(0) = s \) (initial demand), keeping other attributes like price, quantity etc., at a constant level.

The demand is given by the following equation,

\[
D = D(N) = S - (S - s)(1 + rN)(1 - r)^N
\]
This demand function is an $S$-shaped curve (Figure 1) and shows that at the initial stage the credit period may not be effective in realising the demand but as credit period increases it has a significant impact on demand and gradually reaches its saturation level. These types of demand functions are observed in consumer durables.

**Figure 1** Demand vs. credit period (see online version for colours)

Furthermore, as the items are deteriorating in nature, depletion of inventory due to demand and deterioration will occur simultaneously. Let $I(t)$ be the inventory level at any time $t$, $(0 \leq t \leq T)$. The differential equation describing the instantaneous state of $I(t)$ over $(0, T)$ is given by:

$$\frac{dI(t)}{dt} + \theta I(t) = -D(N) \quad 0 \leq t \leq T$$

(3)

Solution to the equation (3) (using the boundary condition $I(t) = 0$ at $t = T$) is given by

$$I(t) = \frac{D}{\theta} [e^{\theta(T-t)} - 1] \quad 0 \leq t \leq T$$

(4)

Also at $t = 0$ $I(t) = Q$

$$\therefore Q = \frac{D}{\theta} [e^{\theta T} - 1]$$

(5)

Using the above demand function, the various components of the retailer’s profit per unit time, $Z(T, N)$ are calculated as follows:

1 sales revenue $= PD$

(6)
2 cost of placing orders = \( A/T \)  

3 cost of purchasing units = \( CQ/T \)  

4 cost of carrying inventory = \( \frac{ICD(e^{\theta T} - 1 - \theta T)}{T\theta^2} \)  

The computation for interest earned and payable will depend on the following three possible cases based on the lengths of \( T, N \) and \( M \): Case 1: \( N \leq M \leq T + N \), Case 2: \( N \leq T + N \leq M \) and Case 3: \( M \leq N \leq T + N \).

**Case 1 \( N \leq M \leq T + N \) (Figure 2)**

In this case, the retailer starts getting actual sales revenues from time \( N \) to \( M \) and earns interest on average sales revenue for the time-period \( (M - N) \). Furthermore, without receiving all the payments from the customers but paying off the supplier at the due date \( M \), the retailer has to bear a capital opportunity cost at the rate \( Ip \) for the items sold but which have not yet been paid by customers.

5 the interest earned per unit time is =  
\[
\frac{I_pP}{T} \int_N^M dt = \frac{I_pPD(M - N)^2}{2T} \]

and

6 the interest payable per unit time is =  
\[
\frac{I_pC}{T} \int_M^{T+N} l(i) \ dt = \frac{I_pCD(e^{\theta(T+N-M)} - 1 - (T + N - M)\theta}{\theta^2T} \]

Using the equations (6) to (11), the retailer’s profit per unit time \( Z(T, N) \) can be expressed as

\[
Z(T, N) = PD - CD \left( \frac{e^{\theta T}}{T^\theta} - 1 \right) - \frac{A}{T} + \frac{ICD}{T\theta^2} \left( e^{\theta T} - 1 - \theta T \right) + \frac{I_pP(D(M - N)^2)}{2T} - \frac{I_pCD(e^{\theta(T+M-N)} - 1 - (T + M - N)\theta}{\theta^2T} \]

using an approximation we get
Retailer’s optimal credit and replenishment policy for deteriorating items

\[ Z_1(T, N) = (P - C) D - \frac{CD\theta T}{2} \left( \frac{A}{T} + \frac{1}{2T} \right) \left\{ I_i P \left( D(M - N)^2 \right) - ICDT^2 - I_e CD (T + N - M)^2 \right\} \]  \hspace{1cm} (13)

**Figure 2** \( N \leq M \leq T + N \)

Case 2 \( N \leq T + N \leq M \) (Figure 3)

In this case, the retailer earns interest on average sales revenues received during the period \((N, T + N)\) and on full sales revenue \((PQ)\) for the period \((M - T - N)\). Since \(M \geq T + N\) the retailer does not incur any opportunity cost.

Consequently the interest earned per unit time is

\[
\frac{I_i P}{T} \left\{ \int_{N}^{T+N} D t \ dt + \int_{T+N}^{M} DT \ dt \right\} = \\
\frac{I_i P \left\{ DT^2 / 2 + DT (M - T - N) \right\}}{T} = I_i PD (M - N - T / 2) \] \hspace{1cm} (14)

As a result, using the equations (6)-(9) and (14), the retailer’s profit per unit time \(Z_2(T, N)\) in this case is

\[
Z_2(T, N) = PD - \frac{CD(e^{\theta T} - 1)}{\theta T} \left( \frac{A}{T} - \frac{ICDT}{2} + I_e PD (M - N - \frac{T}{2}) \right) \] \hspace{1cm} (15)

and after approximation it becomes

\[
Z_2(T, N) = (P - C) D - \frac{CD\theta T}{2} \left( \frac{A}{T} - \frac{ICDT}{2} + I_e PD (M - N - \frac{T}{2}) \right) \] \hspace{1cm} (16)
Case 3  \( M \leq N \leq T + N \) (Figure 4)

In this case, the length of credit period \( M \) offered by the supplier is less than the length of credit period \( N \) offered by the retailer. Therefore, the retailer earns no interest but pays interest for a period of \((N-M)\) and on the average stock held during the cycle length \((T)\).

Consequently the interest payable per unit time is:

\[
\frac{I_pCD}{T} \left( \int_M^N DT \ dt + \int_0^{T+N} D(t) \ dt \right) = \frac{I_pCD(T-M+DT^2/2)}{T}
\]

(17)

As a result, using the equations (6)–(9) and (17), the retailer’s profit per unit time \( Z_3(T, N) \) in this case is

\[
Z_3(T, N) = PD - \frac{CD(e^{\theta T} - 1)}{\theta T} - \frac{A}{T} - \frac{ICDT}{2} - I_pCD(N-M+T/2)
\]

(18)

after approximation it becomes

\[
Z_3(T, N) = (P-C)D - \frac{CD\theta T}{2} - \frac{A}{T} - \frac{ICDT}{2} - I_pCD(N-M+T/2)
\]

(19)

Therefore, the retailer’s profit per unit time \( Z(T, N) \) is

\[
Z(T, N) = \begin{cases} 
Z_1(T, N) & \text{if } N \leq M \leq T+N \\
Z_2(T, N) & \text{if } N \leq T+N \leq M \\
Z_3(T, N) & \text{if } M \leq N \leq T+N 
\end{cases}
\]

(20)
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this is a function of two variable $T$ and $N$ where $T$ is continuous and $N$ is discrete.

Figure 4 $M \leq N \leq T + N$

4 Solution procedure

Our aim is to find the optimum value of $T$ and $N$ which maximises $Z(T, N)$. For a fixed value of $N$, taking the first and second order partial derivatives of $Z_1(T, N), Z_2(T, N)$ and $Z_3(T, N)$ with respect to $T$, we get

\[
Z_1(T, N) = -\frac{CD\theta}{2} + \frac{A}{T^2} - \frac{ICD}{2} - \frac{PI_D(M - N)^2}{2T^2} - \frac{CI_pD}{2T^2} \left( T^2 - (N - M)^2 \right) \tag{21}
\]

\[
Z_2(T, N) = -\frac{2A - D(M - N)^3}{T^3} (CI_p - PI_p) \tag{22}
\]

\[
Z_3(T, N) = -\frac{2A}{T^3} \tag{23}
\]

\[
Z_4(T, N) = -\frac{CD\theta}{2} + \frac{A}{T^2} - \frac{ICD}{2} - \frac{CI_pD}{2} \tag{24}
\]

\[
Z_5(T, N) = -\frac{2A}{T^3} \tag{25}
\]

\[
Z_6(T, N) = -\frac{2A}{T^3} \tag{26}
\]

For fixed $N$, equations (24) and (26) imply that, $Z_4(T, N)$ and $Z_6(T, N)$ are concave on $T > 0$. However, $Z_1(T, N)$ is concave on $T > 0$ if $CI_p > PI_p$. 
Thus, there exists a unique value of $T$ (say $T_1^*$) which maximises $Z_1(T)$,

$$T_1^* = \sqrt{\frac{2A-D(M-N)^2(P_{1, e} + C_{l, p})}{(\theta + I_p + I_p)C}}$$ (27)

$T_1^*$ would satisfy the condition $0 \leq (M - N) \leq T$ provided that

$$2A - D(M-N)^2[I_p + \theta] \geq 0$$ (28)

Substituting equation (27) into (13), we get the optimal value of $Z_1(T)$ (say $Z_1^*$).

Similarly, there exists a unique value of $T$ (say $T_2^*$) which maximises $Z_2(T)$,

$$T_2^* = \sqrt{\frac{2A}{(\theta C + I_p)(pD)}}$$ (29)

$T_2^*$ would satisfy the condition $0 \leq T \leq (M - N)$ provided

$$2A - D(M-N)^2[I_p + \theta] \leq 0$$ (30)

Substituting equation (29) into (16), we get the optimal values of $Z_2(T)$ (say $Z_2^*$).

Likewise, we obtain the optimal value of $T$ (say $T_3^*$) which maximises $Z_3(T)$,

$$T_3^* = \sqrt{\frac{2A}{(I_p + \theta)CD}}$$ (31)

$T_3^*$ would satisfy the condition $(M - N) \leq 0 \leq T$ provided

$$2A - CD(M-N)^2[I_p + \theta] \geq 0$$ (32)

Substituting equation (31) into (19), we get the optimal values of $Z_3(T)$ (say $Z_3^*$).

Combining the three possible cases, we obtain the following theorem.

**Theorem 1:** For a fixed value of $N$,

a) if $2A - D(M-N)^2[I_p + \theta] \geq 0$ then $T^* = T_1^*$

b) if $2A - D(M-N)^2[I_p + \theta] \leq 0$ then $T^* = T_2^*$

c) if $2A - CD(M-N)^2[I_p + \theta] \geq 0$ and $(M - N) < 0$ then $T^* = T_3^*$.

**Proof:** It immediately follows from (28), (30) and (32).
Special case

If the credit period offered by retailer \( N = 0 \) and deterioration rate \( \theta \) is \( = 0 \) then \( D(N) = s \) and Theorem 1 for determining optimal \( T \) will be reduced to

Theorem 2:

a) if \( 2A - DM^2 [I_C + I_P] \geq 0 \) then \( T^* = T_1^* \)

b) if \( 2A - DM^2 [I_C + I_P] \leq 0 \) then \( T^* = T_2^* \).

From the viewpoint of the solution procedure, this is consistent with Theorem 1 as in Teng’s model (2002). Hence, the proposed model gets reduced to Teng (2002).

Now, in order to jointly optimise \( T \) and \( N \), the following algorithm is proposed.

**Algorithm**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set ( N = 1 ).</td>
</tr>
<tr>
<td>2</td>
<td>Determine the optimal values of ( T ) (i.e., ( T_1^* ) or ( T_2^* ) or ( T_3^* )) using Theorem 1.</td>
</tr>
<tr>
<td>3</td>
<td>If ( T \geq M - N \geq 0 ), then calculate ( Z_3(T, N) ), otherwise go to Step 5.</td>
</tr>
<tr>
<td>4</td>
<td>If ( Z_3(T, N) &gt; Z_3(T, N - 1) ), increment the value of ( N ) by 1 and go to Step 2, otherwise the current value of ( N ) is optimal and the corresponding value of ( Z(T, N) ) can be calculated.</td>
</tr>
<tr>
<td>5</td>
<td>If ( 0 \leq T \leq M - N ), then calculate ( Z_3(T, N) ), otherwise go to Step 7.</td>
</tr>
<tr>
<td>6</td>
<td>If ( Z_3(T, N) &gt; Z_3(T, N - 1) ), increment the value of ( N ) by 1 and go to Step 2, otherwise the current value of ( N ) is optimal and the corresponding value of ( Z(T, N) ) can be calculated.</td>
</tr>
<tr>
<td>7</td>
<td>If ( M - N \leq 0 \leq T ) then calculate ( Z_3(T, N) ).</td>
</tr>
<tr>
<td>8</td>
<td>If ( Z_3(T, N) &gt; Z_3(T, N - 1) ), increment the value of ( N ) by 1 and go to Step 2, otherwise the current value of ( N ) is optimal and the corresponding value of ( Z(T, N) ) can be calculated.</td>
</tr>
</tbody>
</table>

5 Numerical example

Let \( S = 100 \) units/day, \( s = 30 \) units/day, \( r = 0.12 \), \( A = $1000 \) /order, \( \theta = 10\% \), \( M = 45 \) days, \( C = $30 \)/unit, \( P = $40 \)/unit, \( I_e = 0.15 \) per year, \( I_c = 0.10 \) per year and \( I = 0.15 \) per year.

Using the proposed algorithm, we obtained the optimal results as: the optimal credit period offered by retailer \( (N^*) = 47 \) days, the optimal cycle length \( (T = T_1^*) = 24.75 \) days, the optimal order quantity \( Q^* = 2455 \) and the profit per day \( Z^* = $905.42 \).

If the retailer does not offer credit to his customers i.e., \( N = 0 \) then, the optimal cycle length \( T^* = 45.84 \) days, the optimal order quantity \( Q^* = 1384 \) and the profit per day \( Z^* = $277.25 \).

It is clearly evident from the above results that the retailer is able to stimulate his demand by offering a trade credit period to his customers. The above results indicate that when \( N = 0 \) i.e., no credit period is offered by the retailer to his customers, his order...
quantity \( Q = 1384 \) and the profit \( Z = $271.25 \). On the other hand when \( N > 0 \) i.e., the retailer offers credit period to his customers, then his order quantity raises by approximately 77% and the resultant profit increases by approximately 234% i.e., \( Q = 2455 \) and \( Z = $905.42 \) respectively.

6 Sensitivity analysis

In order to gain more insight of the model developed, in this section we explore the effect of certain parameters viz. \( \theta, M, I_e \) and \( I_p \) on retailers optimal ordering policy.

Table 1  The effects of changing \( \theta \) and \( M \)

<table>
<thead>
<tr>
<th>( \theta )</th>
<th>( M )</th>
<th>( N )</th>
<th>( Q )</th>
<th>( T )</th>
<th>( Z )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>30</td>
<td>1,574</td>
<td>52.47</td>
<td>272</td>
<td></td>
</tr>
<tr>
<td></td>
<td>46</td>
<td>2,751</td>
<td>27.87</td>
<td>897.99</td>
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<td>47</td>
<td>2,834</td>
<td>27.87</td>
<td>916.27</td>
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<td>53.11</td>
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<td>28.43</td>
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<td>0</td>
<td>1,604</td>
<td>53.48</td>
<td>282.34</td>
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</tr>
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<td>10%</td>
<td>30</td>
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<td>47</td>
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</tr>
<tr>
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<td>1,384</td>
<td>45.84</td>
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<td>47</td>
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<td>895.81</td>
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<td>48</td>
<td>2,212</td>
<td>22.21</td>
<td>913.97</td>
<td></td>
</tr>
</tbody>
</table>

Table 2  Effects of changing \( I_e \) and \( I_p \) on the optimal solution (\( \theta = 10\%, M = 60 \))

<table>
<thead>
<tr>
<th>( I_e \rightarrow I_p )</th>
<th>0.05</th>
<th>0.1</th>
<th>0.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>24.23</td>
<td>23.98</td>
<td>23.41</td>
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<td></td>
<td>48</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>920.38</td>
<td>922.21</td>
<td>924.64</td>
</tr>
<tr>
<td>0.15</td>
<td>25.24</td>
<td>24.87</td>
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</tr>
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<tr>
<td></td>
<td>923.95</td>
<td>925.37</td>
<td>926.79</td>
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The effect of changes in the parameters viz. \( \theta \) and \( M \) has been summarised in Table 1, whereas Table 2 presents the outcome of the variation in \( I_e \) (interest earned) and \( I_p \) (interest paid) on the optimal policy.
There is no doubt, for fixed $M$, that the order quantity and profit decreases with the increase in the rate of deterioration (Table 1), yet, it is to be noticed that the order quantity and the profit increases with the same ratio, for the case when the retailer offers credit period to the case when he does not offer credit period to his customers. Hence, for deteriorating items, it is advisable to the retailer to offer credit to his customers to stimulate his demand and reduce the loss due to deterioration. Further, from the Table 1, it is seen that for a constant $\theta$, as $M$ increases, although there is marginal increase in cycle length and credit period offered by the retailer, but the retailer’s profit increases significantly due to the fact that the retailer can delay his payment to the supplier and the subsequent savings add to his profit. Finally, from Table 2 it is observed that a decrease in the difference of interest payable and interest earned ($I_p - I_e$) will lead to a reduced cycle length and a rise in profit.

7 Conclusions

The influence of trade credit on demand has not yet been explored by the researchers up to its potential. Moreover when the items are of deteriorating in nature, it becomes more significant, as they have shorter life span. However, it is generally observed that initially credit period may not be that effective in realising the demand but as the time passes by it has got a significant impact on demand and gradually reaches its saturation level. In the light of this very fact, this paper studied the impact of credit-linked demand for deteriorating items in a supply chain on the retailer’s optimal credit and replenishment policy with two levels of credit, which caters to multi-consumers. An easy-to-use algorithm is proposed that provides the optimal values of both cycle length as well as credit period offered by the retailer. The research leads to the following observations with which the present paper is concluded. First, and foremost, it is noted that the order quantity and profit increases significantly when the retailer offers trade credit to his customers, thereby implying that retailer is able to stimulate his demand by offering trade credit to his customers. Moreover, the sensitivity analysis reveals that as the rate of deterioration increases the order quantity and profit of the retailer decreases, yet, it is to be noticed that the order quantity and the profit increases with the same ratio, for the case when the retailer offers credit period to the case when he does not offer credit period to his customers. Subsequently, the analysis shows that, an increase in $M$ results in an increase in profit. The final section of the study showed that there is a rise in profit as the difference between interest payable and interest earns decreases. The future study can extend the present model for different forms of credit linked demand functions, inflation, supplier-buyer integrated inventory model etc.

Acknowledgements

The authors are grateful to the anonymous referees for their useful suggestions and comments. The first author would like to acknowledge the financial support provided by the University of Delhi, Delhi, India, Grants No. Dean(R)/R&D/2009/487.
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