OPTIMAL ORDERING POLICY IN DEMAND DECLINING MARKET UNDER INFLATION WHEN SUPPLIER CREDITS LINKED TO ORDER QUANTITY

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Abstract: In this research paper, a lot–size model is proposed when supplier offers the retailer a credit period to settle the account if the retailer orders a large quantity. The proposed study is meant for demand declining market. Here, the retailer needs to arrive at a static decision when demand of a product is decreasing and on the other side the supplier offer the credit period if the retailer orders for more than pre–specified quantity. Shortages are not allowed and the effect of inflation is incorporated. The objective to minimize the total cost in demand declining market under inflation when the supplier offers a credit period to the retailer if the ordered quantity is greater than or equal to pre–specified quantity. An easy – to – use flow chart is given to find the optimal replenishment time and the order quantity. The mathematical formulation is supported by a numerical example. The sensitivity analysis of parameters on the optimal solution is carried out.

Keywords: Demand declining market, inflation, trade credit, lot – size.

1. Introduction

Wilson’s classical economic order quantity (EOQ) model is derived under the assumption that the demand of the product is uniform over a time. However, the demand of seasonal goods, weather selected garments, Christmas tree etc. decreases after the practical phase is over. The another stringent assumption of the classical EOQ is that the retailer settles the due accounts for the items as soon as items are received in his inventory system. In practice, the supplier offers a permissible credit period to the retailer if the outstanding amount is paid within the allowable credit period and the order quantity is larger than that specified by the supplier. The credit period

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is treated as a promotional tool to attract more customers. It can be regarded as a kind of price discount because paying later indirectly reduces the purchase cost, motivating the retailer to increase his order quantity. Goyal [9] developed an EOQ model under the conditions of permissible delay in payments. Shah et al. [12] extended Goyal’s model by allowing shortages. Mandal and Phaujdar [10] included interest earned from the sales revenue on the stock remaining beyond the settlement period Chung and Hung [4] studied Goyal’s model when replenishment rate is finite.

Davis and Gaither [8] derived optimal policy for the firm that offers a one time opportunity to delay payment for an order of a commodity. Such delayed payments results in a reduction of the effective purchase cost, which is a function of the return available on alternative investments, the number of units of commodity ordered and the length of the extended period Chung [3] established the convexity of the total annual variable cost function for optimal economic order quantity under conditions of permissible delay in payments analytically, it is shown that the economic order quantity under conditions of permissible delay in payments is generally higher than the economic order quantity given by the Wilson’s formula.

Using principles of financial analysis, Dallenbach [6, 7], Ward and Chapman [13], Chapman and Ward [1] argued that if trade credit has the characteristic of a renewable source of capital, then the usual assumption that the value of the inventory investment opportunity cost made by the traditional inventory theory is correct. Chung et al. [5] computed the economic order quantity under conditions of the permissible delay time in payments depends on the quantity ordered when the order quantity at which the delay in payments is allowed, the payment for the item should be settled immediately. Otherwise, the fixed credit period is allowed. Some more interesting articles are by Samanta and Bhowmick [13], Roy and Samanta [12], Sugapriya and Jeyaraman [15].

The average cost approach does take into account the time value of money. Hence, there is no distinction between out – of pocket holding cost and opportunity cost due to inventory investments. To overcome this scenario, researchers suggested discounted – cash – flow (DCF) approach which allows proper recognition of the financial implication of the opportunity cost and out – of pocket costs in the inventory analysis. Chung [2] presented DCF – approach for the analysis of the optimal inventory policy under the effect of the trade credit. Rachmadugu [11] established that the best order quantity is an increasing function of allowable delay period.

In this paper, an attempt is made to formulate lot – size model when demand of the commodity is decreasing under inflation. The supplier offers to the retailer a credit period for a larger order that is greater than or equal to pre – specified quantity. It is assumed that if the order is less than the pre – specified quantity then the retailer must settle the account immediately for the items received. An easy – to – use flow chart is given to derive the optimal decision. The numerical example is given to support the working rules for the optimal solution. The sensitivity analysis is carried out to examine the effect of parameters on the optimal solution.

2. Notation and assumptions

The following notations and assumptions are used for the development of proposed model.
2.1 Notations

- $H$: the length of planning horizon
- $R(t) = a (1 - bt)$: the demand rate, where $'a'$ denotes constant demand and $'b'$ is rate of change of demand with respect to time where $a, b > 0$, $a \gg b$
- $h$: the holding cost rate per unit time excluding interest charges.
- $r$: constant rate of inflation per unit time where $0 < r < 1$
- $P(t)$: the selling price per unit at time $t$, where $P$ is the unit selling price at $t = 0$.
- $C(t)$: the purchase cost per unit at time $t$, where $C$ is the unit purchase cost at $t = 0$.
- $A(t)$: the ordering cost per order at time $t$, where $A$ is the ordering cost at $t = 0$.
- $M$: the permissible trade credit in settling the account.
- $I_c$: the interest charged per $ in stocks per annum by the supplier.
- $I_e$: the interest earned per $ per year

Note: $I_c < I_e$

- $Q$: the order quantity (decision variable)
- $Q_{d}$: the pre-specified quantity at which the delay in payments is allowed
- $T_{d}$: the time at which $Q_{d}$ – units are depleted to zero due to declining demand
- $I(t)$: the inventory level at any instant of time $t$, $0 \leq t \leq T$.
- $T$: the replenishment time (decision variable)
- $K(T)$: the total cost over finite planning horizon of length $H$

2.2 Assumptions

1. The inventory system deals with a single item.
2. The demand $R(t) = a (1 - bt)$ is decreasing function of time $t$, where $a$ denotes the constant demand and $b$ denotes the rate of change of demand with respect to time $t$, $a > 0$, $b > 0$, $a > b$, $0 < b < 1$.
3. The inflation rate is constant.
4. Shortages are not allowed and the lead time is zero or negligible.
5. If the order quantity is less than $Q_{d}$, then the payments for the goods received must be done immediately.
6. If the order quantity is greater than or equal to $Q_{d}$, then the delay in payments up to $M$ is allowed. During the permissible delay period, the account is not settled; the generated sales revenue is deposited in an interest bearing account. At the end of the delay period, the retailer pays off all units orders and start paying the interest charges on the items in stock.

3. Mathematical Model

We assumed that the length of planning horizon is $H = nT$; where $n$ is an integer for the number of orders to be made during period $H$, and $T$ is the replenishment time. The inventory
level; \( I(t) \) depletes to meet the demand. The rate of change of inventory level at any instant of time is governed by the following differential equation.

\[
\frac{dI(t)}{dt} = -R(t) \quad ; \quad 0 \leq t \leq T
\]  

(1)

with the boundary condition \( I(0) = Q \) and \( I(T) = 0 \). Consequently, the solution of differential equation (1) is given by:

\[
I(t) = a \left[ T - t + \frac{b}{2} (t^2 - T^2) \right] \quad ; \quad 0 \leq t \leq T
\]  

(2)

and the order quantity is:

\[
Q = I(0) = a \left[ T - \frac{b}{2} T^2 \right]
\]  

(3)

From (3), we can obtain the cycle time at which \( Q_d \) units are reduced to zero. In fact, \( T_d \) is the solution of:

\[
T_d = \frac{a \pm \sqrt{a^2 - 2abQ_d}}{ab}
\]  

(4)

It is clear \( Q < Q_d \) holds if and only if \( T < T_d \). Since the time intervals are of equal length, using (2) we have:

\[
I(kT + t) = a \left[ T - t + \frac{b}{2} (t^2 - T^2) \right] \quad 0 \leq k \leq n - 1, \quad 0 \leq t \leq T
\]  

(5)

The total cost for the planning horizon consists of the following cost components.

1. Ordering Cost

\[
OC = A(0) + A(T) + A(2T) + \ldots + A((n-1)T) = A \left( \frac{e^{HT} - 1}{e^{HT} - 1} \right)
\]  

(6)

2. Purchase cost:

\[
PC = Q \left[ C(0) + C(T) + C(2T) + \ldots + C((n-1)T) \right] = a \left( T - \frac{1}{2} bT^2 \right) \left( \frac{e^{HT} - 1}{e^{HT} - 1} \right)
\]  

(7)
3. Inventory holding cost:

\[
IHC = h \sum_{k=0}^{n-1} C(kT) \int_0^T I(kT + t)dt = \frac{hCaT^2}{6} \left( e^{e^{HT}} - 1 \right) \left( e^{e^{HT}} - 1 \right)
\]

For the interest charged and the interest earned, we have four possible cases based on the values of \( T, M \) and \( T_d \).

**Case 1:** \( 0 < T < T_d \)

Here, replenishment cycle time \( T \) is less than \( T_d \) and so the delay in payments is not allowed. The retailer must pay immediately for the units received. This is the scenario of the classical EOQ model. The retailer has to pay interest charges for all unsold items. Hence, interest charged payable during planning horizon \( H \) is:

\[
IC_1 = I_c \sum_{k=0}^{n-1} C(kT) \int_0^T I(kT + t)dt = \frac{CI_c^2 aT^2}{6} \left( e^{e^{HT}} - 1 \right) \left( e^{e^{HT}} - 1 \right)
\]

Therefore, the total cost during planning horizon is:

\[
Z_1(T) = OC + PC + IHC + IC_1
\]

**Case 2:** \( T_d \leq T < M \)

Since, \( T < M \), there is no interest charges and interest earned during planning horizon is:

\[
IE_2 = I_c \sum_{k=0}^{n-1} P(kT) \int_0^T R(t)dt + R(T)T(M - T)
\]

\[
= PL_c a \left[ \frac{T^2(3-2bT)}{6} \right] \left( e^{e^{HT}} - 1 \right) \left( e^{e^{HT}} - 1 \right)
\]

As a result, total cost in this case during the planning horizon is:

\[
Z_2(T) = OC + PC + IHC - IE_2
\]

**Case 3:** \( T_d \leq M \leq T \)

In this case, cycle time is greater than both \( T_d \) and \( M \). Hence, the trade credit is allowed. Here, total cost of an inventory system will have two additional components viz. interest charged and interest earned. The interest charged during planning horizon is:
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\[ IC_1 = \sum_{k=0}^{n-1} C(k) \left[ \int_0^{T_M} I(kT + t)dt \right] = CI_\epsilon a \left[ \frac{1}{2} T^2 - \frac{1}{3} bT^3 - TM \right] \left[ \frac{e^{rH} - 1}{e^{rT} - 1} \right] \]  

(13)

and interest earned is:

\[ IE_2 = \sum_{k=0}^{n-1} P(kT) \left[ \int_0^M R(t)tdt \right] = \frac{1}{6} PI_\epsilon aM^2 (3 - 2bM) \left( \frac{e^{rH} - 1}{e^{rT} - 1} \right) \]  

(14)

Hence, the total cost is:

\[ Z_3(T) = OC + PC + IHC + IC_3 - IE_3 \]  

(15)

**Case 4: M \leq T_d \leq T**

In this case, the replenishment cycle time \( T \) is greater than or equal to both \( T_d \) and \( M \). Thus, case 4 is similar to case 3, therefore, the total cost during planning horizon is:

\[ Z_4(T) = OC + PC + IHC + IC_3 - IE_3 \]  

(16)

4. **Theoretical Discussion**

Since, the value of inflation \( r \) is very small, using a truncated Taylor series expansion for the exponential term, we have:

\[ e^{rH} \approx 1 + rH + \frac{r^2H^2}{2} \]  

(17)

\[ e^{rT} \approx 1 + rT + \frac{r^2T^2}{2} \]  

(18)

Using the above approximations, the total cost \( Z_k(T) \), \( k = 1, 2, 3, 4 \) can be written as:

\[ Z_k(T) = \left( A + Ca \left( T - \frac{1}{2} bT^2 \right) + (h + I_s) CaT^2 \frac{3 - 2bT}{6} \right) \left( \frac{rH + \frac{1}{2} r^2H^2}{rT + \frac{1}{2} r^2T^2} \right) \]  

(19)
\[
Z_2(T) = \left( A + Ca \left( T - \frac{1}{2} b T^2 \right) + hCaT^2 \left( 3 - 2bT \right) \right) \left( \frac{rH + \frac{1}{2} r^2 H^2}{rT + \frac{1}{2} r^2 T^2} \right) + PI_aT^2 \left( 3 - 2bT \right) + \left( 1 - bT \right) T (M - T)
\]

\[
Z_z(T) = \left\{ A + Ca \left( T - \frac{1}{2} bT^2 \right) - Pl_aM^2 \left( 3 - 2bM \right) \right\} \left\{ \frac{rH + \frac{1}{2} r^2 H^2}{rT + \frac{1}{2} r^2 T^2} \right\}
\]

\[
Z_1(T) = \left\{ A + Ca \left( T - \frac{1}{2} bT^2 \right) + hCaT^2 \left( 3 - 2bT \right) \right\} \left\{ \frac{rH + \frac{1}{2} r^2 H^2}{rT + \frac{1}{2} r^2 T^2} \right\}
\]

The necessary condition for \( Z_1(T) \) in (3.19) is:

\[
dZ_1 = \frac{dZ_1}{dT} = \frac{-A(r + r^2 T)}{rT + \frac{1}{2} r^2 T^2} + Ca(1 - bT) - \frac{Ca \left( T - \frac{1}{2} bT^2 \right) (r + r^2 T)}{rT + \frac{1}{2} r^2 T^2} = 0
\]

Similarly,}

\[
dZ_2 = \frac{dZ_2}{dT} = \frac{-A(r + r^2 T)}{rT + \frac{1}{2} r^2 T^2} + Ca(1 - bT) - \frac{Ca \left( T - \frac{1}{2} bT^2 \right) (r + r^2 T)}{rT + \frac{1}{2} r^2 T^2} = 0
\]
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\[
\frac{dZ_2}{dT} = \left\{ \begin{array}{l}
-A\left( \frac{r^2}{rT+\frac{1}{2}r^2T^2} \right) + Ca(1-bT) - \frac{Ca\left( T - \frac{1}{2}bT^2 \right) \left( r + r^2T \right) + hCaT(3-2bT)}{rT+\frac{1}{2}r^2T^2} \right. \\
- \left. \frac{hCaT^2}{6} - \frac{hCaT^2(3-2bT) \left( r + r^2T \right) + Cl_a(a \left( T - bT^2 - M + bMT \right) + \frac{T}{6} \right)}{rT+\frac{1}{2}r^2T^2} \right. \\
+ \left. \frac{CI_a(a \left( T - bT^2 - M + bMT \right) + \frac{T}{6} \right)}{rT+\frac{1}{2}r^2T^2} \right. \\
\frac{rH + \frac{1}{2}r^2H^2}{rT + \frac{1}{2}r^2T^2} = 0
\end{array} \right.
\]

\[
\frac{dZ_3}{dT} = \left\{ \begin{array}{l}
\frac{hCaT^2}{6} - \frac{hCaT^2(3-2bT) \left( r + r^2T \right) + Cl_a(a \left( T - bT^2 - M + bMT \right) + \frac{T}{6} \right)}{rT+\frac{1}{2}r^2T^2} \\
+ \frac{CI_a(a \left( T - bT^2 - M + bMT \right) + \frac{T}{6} \right)}{rT+\frac{1}{2}r^2T^2} \right. \\
\frac{rH + \frac{1}{2}r^2H^2}{rT + \frac{1}{2}r^2T^2} = 0
\end{array} \right.
\]

The sufficient conditions are:

\[
\frac{d^2Z_1}{dT^2} = \frac{-2H(2 + rH) + 12A + 4I_cCaT^3b - 9Ar^2T^2 + 3I_cCaT^3r - 18ArT}{3T^3(2 + rT)^3} \left( -3CaT^3r^2 - 3CaT^3br + 3hCaT^3r + 4hCaT^3b \right)
\]

\[
> 0
\]

\[
\frac{d^2Z_2}{dT^2} = \frac{-2H(2 + rH) + 12A + 3CaT^3r^2 + 9Ar^2T^2 + 18ArT + 3CaT^3br - 3hCaT^3r}{3T^3(2 + rT)^3} \left( -4hCaT^3b + 3I_cPaT^3r + 8I_cPaT^3r + 6Pl_aT^3bMr + 3Pl_aT^3Mr^2 \right)
\]

\[
> 0
\]
\[
\frac{d^2 Z}{dT^2} = \frac{H(2 + rH)}{3T^3(2 + rT)^3} \left(-24A - 18Ar^2T^2 - 36ArT - 6CaT^3r^2 - 6CaT^3br + 6hCaT^3r + 8hCaT^3b + 6I_CaT^3r - 12Cl_TaM^2 + 6Cl_TaM^3bMr + 12PI_aM^2 + 4I_CaM^3 + 6I_CaM^3rT - 18I_CaM^2rT + 18PI_aM^2rT - 8PI_aM^3b - 12PI_aM^3brT + 6Cl_TaM^3Mr^2 + 3Cl_abM^3r^2T^2 - 9I_CaM^2r^2T^2 + 9PI_aM^3r^2T^2 - 6PI_aM^3br^2T^2\right)
\]

(29)  

\[
\frac{d^2 Z_4}{dT^2} = \frac{H(2 + rH)}{3T^3(2 + rT)^3} \left(-24A - 18Ar^2T^2 - 36ArT - 6CaT^3r^2 - 6CaT^3br + 6hCaT^3r + 8hCaT^3b + 6I_CaT^3r - 12Cl_TaM^2 + 6Cl_TaM^3bMr + 4I_CaM^3 + 6I_CaM^3rT - 18I_CaM^2rT + 12PI_aM^2 + 18PI_aM^2rT - 8PI_aM^3b - 12PI_aM^3brT + 6Cl_TaM^3Mr^2 + 3Cl_abM^3r^2T^2 - 9I_CaM^2r^2T^2 + 9PI_aM^3r^2T^2 - 6PI_aM^3br^2T^2\right)
\]

(30)  

5. **Computational Flow Chart**

To obtain optimal solution, decision maker can use following flow – chart (figure 1).

![Computational Flow Chart](image-url)
6. Numerical Examples

Consider following parametric values in proper units.

\[ [H, a, b, h, I_c, I_e, r, C, P, M, A] = [1, 50, 0.10, 2, 0.10, 0.06, 0.05, 20, 50, \frac{30}{365}, 120] \]

then if \( Q_d = 6, 15 \) solving (3.26) for \( T_4 \) gives = 0.3636 and corresponding minimum total cost is \$1702.84 and corresponding \( \frac{d^2Z_4(T_4)}{dT_4^2} = 4930 > 0 \) for all \( T_4 \).

**Example 1** (for first case)

\[ [H, a, b, h, I_c, I_e, r, C, P, M, A] = [1, 50, 0.10, 2, 0.10, 0.06, 0.05, 20, 50, \frac{30}{365}, 120] \]

and \( Q_d = 35 \) gives \( T_d = 0.7264 \). Solving (3.23) for \( T_1 \) gives = 0.3636 and corresponding minimum total cost is \$1710.94 and corresponding \( \frac{d^2Z_1(T_1)}{dT_1^2} = 4926 > 0 \) for all \( T_1 \).

**Example 2** (for second case)

\[ [H, a, b, h, I_c, I_e, r, C, P, M, A] = [1, 50, 0.10, 2, 0.10, 0.06, 0.05, 20, 50, \frac{150}{365}, 120] \]

then \( Q_d = 15 \) gives \( T_d = 0.3046 \). Solving (3.26) for \( T_2 \) gives = 0.3842 and corresponding minimum total cost is \$1712.37 and corresponding \( \frac{d^2Z_2(T_2)}{dT_2^2} = 4973 > 0 \) for all \( T_2 \).

**Example 3** (for third case)

\[ [H, a, b, h, I_c, I_e, r, C, P, M, A] = [1, 50, 0.10, 2, 0.10, 0.06, 0.05, 20, 50, \frac{120}{365}, 120] \]

and \( Q_d = 15 \) gives \( T_d = 0.3046 \). Solving (3.26) for \( T_3 \) gives = 0.3641 and corresponding minimum total cost is \$1679.79 and corresponding \( \frac{d^2Z_3(T_3)}{dT_3^2} = 4934 > 0 \) for all \( T_3 \).

**Example 4** (for fourth case)

\[ [H, a, b, h, I_c, I_e, r, C, P, M, A] = [1, 50, 0.10, 2, 0.10, 0.06, 0.05, 20, 50, \frac{30}{365}, 120] \]

and \( Q_d = 15 \) gives \( T_d = 0.3046 \). Solving (3.26) for \( T_4 \) gives = 0.3636 and corresponding minimum total cost is \$1702.84 and corresponding \( \frac{d^2Z_4(T_4)}{dT_4^2} = 4930 > 0 \) for all \( T_4 \).
Next we study effect of changes in critical parameter on decision variables and objective function with data same as given in example 4.

**Table 1. Variations in $Q_d$.**

<table>
<thead>
<tr>
<th>$Q_d$</th>
<th>$T$</th>
<th>$Q$</th>
<th>$Z$</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.3636</td>
<td>17.8492</td>
<td>1694.9357</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>0.3636</td>
<td>17.8492</td>
<td>1694.9357</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>0.3637</td>
<td>17.8526</td>
<td>1710.9357</td>
<td>1</td>
</tr>
</tbody>
</table>

The number of pre-specified units to be procured is varied in Table 1. When $Q_d$ is increased it increases the total cost of an inventory system.

**Table 2. Variations in $r$.**

<table>
<thead>
<tr>
<th>$r$</th>
<th>$T$</th>
<th>$Q$</th>
<th>$Z$</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>0.3636</td>
<td>17.85</td>
<td>1702.84</td>
<td>3</td>
</tr>
<tr>
<td>0.07</td>
<td>0.3670</td>
<td>18.01</td>
<td>1713.25</td>
<td>3</td>
</tr>
<tr>
<td>0.09</td>
<td>0.3705</td>
<td>18.18</td>
<td>1723.52</td>
<td>3</td>
</tr>
</tbody>
</table>

The inflation rate is increased in Table 2. Increase in inflation rate increase cycle time, optimum procurement quantity and total cost of an inventory system.

**Table 3. Variations in $a$.**

<table>
<thead>
<tr>
<th>$a$</th>
<th>$T$</th>
<th>$Q$</th>
<th>$Z$</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0.3636</td>
<td>17.85</td>
<td>1702.84</td>
<td>3</td>
</tr>
<tr>
<td>150</td>
<td>0.2067</td>
<td>30.69</td>
<td>4250.01</td>
<td>3</td>
</tr>
<tr>
<td>200</td>
<td>0.1785</td>
<td>35.39</td>
<td>5454.83</td>
<td>3</td>
</tr>
</tbody>
</table>

The increase in constant demand decreases cycle time, increases optimum purchase quantities and total cost of an inventory system. The decision variables and objective function is very sensitive to changes in $a$.

**Table 4. Variations in $b$.**

<table>
<thead>
<tr>
<th>$b$</th>
<th>$T$</th>
<th>$Q$</th>
<th>$Z$</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>0.3636</td>
<td>17.85</td>
<td>1702.84</td>
<td>3</td>
</tr>
<tr>
<td>0.12</td>
<td>0.3678</td>
<td>17.98</td>
<td>1697.25</td>
<td>3</td>
</tr>
<tr>
<td>0.15</td>
<td>0.3745</td>
<td>18.19</td>
<td>1688.71</td>
<td>3</td>
</tr>
</tbody>
</table>

The rate of change of demand; $b$ increase cycle time and decreases purchase units and total cost of an inventory system marginally.
Table 5. Variations in $A$.

<table>
<thead>
<tr>
<th>$A$</th>
<th>$T$</th>
<th>$Q$</th>
<th>$Z$</th>
<th>Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.3308</td>
<td>16.27</td>
<td>1644.29</td>
<td>3</td>
</tr>
<tr>
<td>120</td>
<td>0.3636</td>
<td>17.85</td>
<td>1702.84</td>
<td>3</td>
</tr>
<tr>
<td>150</td>
<td>0.4083</td>
<td>20.00</td>
<td>1781.75</td>
<td>3</td>
</tr>
<tr>
<td>170</td>
<td>0.4359</td>
<td>21.32</td>
<td>1829.81</td>
<td>3</td>
</tr>
</tbody>
</table>

The effect of variations in ordering cost is very significant. Increase in ordering cost decreases cycle time and increases optimum procurement quantities and total cost of an inventory system.

Table 6. Variations in $M$.

<table>
<thead>
<tr>
<th>$M$</th>
<th>$T$</th>
<th>$Q$</th>
<th>$Z$</th>
<th>case</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/365</td>
<td>0.3636</td>
<td>17.8491</td>
<td>1702.84</td>
<td>3</td>
</tr>
<tr>
<td>45/360</td>
<td>0.3635</td>
<td>17.8494</td>
<td>1698.86</td>
<td>3</td>
</tr>
<tr>
<td>60/365</td>
<td>0.3636</td>
<td>17.8511</td>
<td>1694.94</td>
<td>3</td>
</tr>
</tbody>
</table>

The increase in delay period decreases total cost because retailer can earn more interest and having some cost savings.

7. Conclusion

An EOQ model is developed under inflation when demand of a product is decreasing in the market to determine the optimal ordering policy when the supplier provides a trade credit linked to order quantity. The effect of the values of the parameters on the optimal solution is studied to illustrate the developed theoretical results. The following managerial phenomena are observed:

1. A higher value of minimum order quantity for avail of a permissible trade credit lowers the optimal order quantity and increases the total cost;
2. Increase in ordering cost increases optimal cycle time and total cost of an inventory system;
3. Increase in delay period lowers the total cost of an inventory system;
4. Increase in inflation rate increases order quantity and total cost of an inventory system.
Increase in demand rate increases total cost of an inventory system.

References


