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An Inventory Model on Preservation Technology with Trade Credits under Demand Rate Dependent on Advertisement, Time and Selling Price

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Abstract In this paper, we propose a manufacturing reliability inventory model in which demand depends on the factors advertisement, time, and selling price. Here we consider lead time is zero, and shortages are not allowed. The manufacturing rate depends on the order level. In a real-life situation, the supplier offers a credit limit to the customer during there is no interest charged. Still, upon the expiry of the prescribed time limit, the supplier will charge some interest. However, the customer has the reserve capital to initially make the payments but decides to benefit from the credit limit. The most critical factor, i.e. deterioration plays a significant role in the field of inventory. Here we consider it a constant rate of decline, and the resources of degradation are essential in several inventories. It is assumed that non-instantaneous deteriorating substances are reserved at a holding charge. The whole study is based on preservation techniques, trade credits, demand, inflation, and deterioration. This study has two primary purposes; first, the mathematical model of an inventory system is established under the above conditions. Second, this study demonstrates that the optimal solution not only exists but also remains feasible. A numerical example validates the proposed model, and the graphs are plotted, and its analysis is done. This study is beneficial in industries for the production of food products and fashionable items, etc.

Keywords Reliability Advertisement, Trade Credit (Permissible Delay Period), Manufacture, Inflation, Deterioration Rate

1. Introduction

Generally, an inventory defined as the stock of idle resources in a firm for future use. In organizations, inventory can be of different types. Manufacturing organizations typically have inventories of raw materials, components, sub-assemblies, tools and equipment, semi-finished goods, finished goods, etc. In service organizations such as banks, financial institutions, hospitals, etc. the inventory consists of various items to be used in multiple forms such as brochures and pamphlets (for details of different banking policies, schemes, and instruments), etc. Banks also have inventories of currency notes and coins. Hospitals have stocks of medical equipment such as a syringe, thermometer, drip, various one-time instruments used by medical professionals, etc. Other accessories such as bandages, cotton, spirit, etc. in addition to multiple medicines. Thus, no organization works without inventory. The conservation innovation is a significant device to expand the presentation of any stock models, and numerous specialists created models with this instrument. For example, Singh et al. [12] built up an ideal stock model for breaking down things with conservation innovation. Singh et al. [3] built up an EOQ model for blurring items having stock ward requests with reasonable postponement and safeguarding innovation. Rathore [6] built up a protection innovation model for crumbling things with promotion subordinate interest rates.

The notable EOQ model implicitly accepts that installment must be made to the provider following the retailer gets the things. In any case, such an assumption isn't really what occurs in reality. In custom, the provider may frequently permit the retailer to have confident financing to expand the interest. The seller allows the purchaser a credit period for settling the sum owed during which no enthusiasm on the amount owed charged. Goyal [11] first developed an EOQ model under the state of passable postponement in installments. Chand and Ward [14] presented Goyal's model under various presumptions of the traditional EOQ model. Aggarwal and Jaggi [10] created requesting arrangements of crumbling things under possible postponement in installments. Kumar et al. [2] created a stock model for ideal requesting strategies for a provider who offers dynamic postpone periods to the retailer to settle his/her record. Singh et al. [3] developed an EOQ model for blurring items having stock ward requests with allowable postponement and conservation devices. Panda et al. [7] created an exchange credit office taken from the retailer and all the potential cases and sub-cases.

Development is the most significant factor which influences the stock framework. Development impacts the benefits work just as the all-out cost work, to decide the ideal stock strategies so that the effect of growth can't be ignored. At first, Buzacott [13] gave the EOQ model growth after Buzacott. A considerable number of specialists broadened the concept by Buzacott and hence clarified the impact of expansion on various expenses. Kumar et al. [1] portrayed a stock model with a quadratic interest rate for decaying things with available deferral in installments and swelling. Ghandehari et al. [8] developed an EOQ model for falling apart things with fractional accumulating and money related contemplations.

Decay is a specific procedure that can't be halted; it must be eased back. Every single valuable thing is inclined to this procedure. A few elements add to weakening, and these components are interconnected, with one expanding the seriousness of another. Being comfortable with the reasons for decay is the initial phase in easing back the procedure. The word deteriorating is considered as decompose or damaged or most extremely reduced or obsolete and so forth as indicated by the various items. There are a few items crumble or rot during their capacity period, for example, organic products, vegetables, eggs, rice, wheat, and occasional items and so forth and a few items are expired because of the appearance of new things in the market with modern innovation, for example, electronic items, autos, and radioactive substances and so on. Numerous scientists built up their work taking weakening in their model, for example, Shah and Jaiswal [4] researched a request level stock and adjusted the model of Agarwal [5] by expecting a fixed pace of decay. Singh [9] examined a creation stock model of decaying things withholding cost, stock, and selling value with an overabundance rate.

In this paper, we established a manufacturing reliability inventory model in which demand depends on advertising, time, and selling price. The manufacturing rate is occupied instantly. In a real-life condition, wholesalers always offer a trade credit period to their retailers, and the whole study is based on an inflationary situation.

2. Mathematical Modeling of the Model

2.1. Assumptions

- The items are created at an unending pace of production;
- Demand rate is given as:
- $D(\psi, \alpha, t) = \alpha t \psi^{t}$, where $\alpha, \psi > 0$
- Shortages are not allowed;
- Lead time is zero;
- Deteriorating rate is assumed as:

Deterioration rate

$$= \{(0;\ 0 \le t \le t_{\omega}, \qquad \omega;\ t_{\omega} \le t \le T)\}$$

where $0 < \omega < 1$ and t_{ω} is a maximum lifetime of an item

Production cost per item is defined as: $C_P = bQ^{-\gamma}$ where $0 < b; 0 < \gamma < 1$;

- Holding cost (C_h) per item is straightforwardly identified with the manufacture cost (C_p) as $C_h = hC_p$ where h is a constant such that $0 < h < 1$.

The complete charge of interest and decline manufacture cycle is portrayed as beneath:

IDP = $f(C_0, r) = \mu C_0^{-\delta} r^{\epsilon}$, where constants μ, δ, ϵ are all positive; C_0 is set up cost and r is the development reliability feature therefore only r items are used to satisfy the demand.

- Delay period (T_M) is provided to the customer for setting an account to receive sales income. After this delay period a high interest rate is charged to the customer for outstanding stock.

2.2. Notation

C_0: The set-up cost;
C_P: Production cost per item;
α: Selling price per item;
C_h: Holding cost per unit/ time;
C_{ψ}: Advertisement cost/advertisement;

Q: Order level;

q(ξ): The preservation technology function where ξ preservation cost /unit/time unit, it is defined as $q(\xi) = \omega e^{-q\xi}$: $\omega, q > 0$.

r: Development reliability-factor;

T: Total length of cycle;

t_ω: Fixed lifetime of the item;

ψ: Advertisement factors.

T_M: Delay payment period;

I_r: Inflation rate;

I_e: Interest earned by customer/ $ in stock/ year;

I_c: Interest charged by purchaser;

$I_1(t)$: Instant inventory level throughout the period $0 \le t \le t_\omega$

$I_2(t)$: The complete appropriate cost / time unit $t_\omega \le t \le T$.

$TC_1(Q, C_0, r)$: The complete proper cost/ time unit in $T \le T_M$;

$TC_2(Q, C_0, r)$: The complete proper cost / time unit $t_\omega \le t \le T$;

SC: The set-up cost;

PC: The purchase cost;

HC: The holding cost;

AC: Advertisement cost;

IP: The interest paid for unsold at principal period or after the permissible delay M;

IE_i : The interest received for i =1 and 2.

IDP: The cost of reproduction and reduction per manufacture cycle.

In the proposed inventory model, the stock's utilization is due to demand only as the lifetime of the item t_ω. After the start of the immediate t_ω, the inventory decreased due to the bond effect of deterioration and the demand. At the time t = T, total inventory ceases up to zero levels.

The differential equations, which govern the entire stock utilization is as per the following:

$$\frac{dI_1}{dt} = -\alpha t \psi^t \quad 0 \le t \le t_\omega \tag{1}$$

$$\frac{dI_2}{dt} + \omega e^{-q\xi} I_2 = -\alpha t \psi^t \quad t_\omega \le t \le T \tag{2}$$

Using the initial conditions $I_1(t=0) = rQ, I_1(t = t_\omega) = I_2(t = t_\omega)$ and $I_2(t = T) = 0$.

Thus, the solution of equations (1) and (2) are as follows:

$$I_1(t) = \alpha\psi^t log\psi(log\psi - t) + rQ - \alpha(log\psi)^2 \tag{3}$$

$$I_2(t) = \frac{\alpha\psi^t}{\omega e^{-q\xi} + log\psi}(1-t) + (1-T) \tag{4}$$

$$Qr = \frac{\alpha\psi^{t_\omega}}{\omega e^{-q\xi} + log\psi}(1-t_\omega) + (1-T) + \alpha\psi^{t_\omega} log\psi(t_\omega - log\psi) + \alpha(log\psi)^2 \tag{5}$$

Now, to compute the following cost:

Set-up cost (SC) = C_o

Purchase cost (PC) = C_p Q

Total holding cost (C) is

$$\boldsymbol{C = C_h \int_0^{t_\omega} I_1(t) e^{-I_r t} dt + C_h \int_{t_\omega}^{T} I_2(t)\, e^{-I_r t} dt}$$

$$\boldsymbol{C = C_h \alpha log\psi \left\{\frac{log\psi}{I_r - log\psi} - \frac{\psi^{t_\omega} log\psi e^{-I_r t_\omega}}{I_r - log\psi} + \frac{\psi^{t_\omega} t e^{-I_r t_\omega}}{I_r - log\psi} - \frac{1}{(I_r - log\psi)^2} - \frac{\psi^{t_\omega} e^{-I_r t_\omega}}{(I_r - log\psi)^2}\right\} + \frac{C_h \alpha}{\omega e^{-q\xi} + log\psi}\left\{\frac{\psi^{t_\omega}(1-t_\omega) e^{-I_r t_\omega}}{I_r - log\psi} - \frac{\psi^T (1-T) e^{-I_r T}}{I_r - log\psi} + \frac{\psi^{t_\omega} e^{-I_r t_\omega}}{(I_r - log\psi)^2} - \frac{\psi^T e^{-I_r T}}{(I_r - log\psi)^2} + \frac{C_h(1-T)}{I_r}\left(e^{-I_r t_\omega} - e^{-I_r T}\right)\right\}} \tag{6}$$

Now, the interest paid, and earned by the customers based on the delay period T_M:

Case 1: When $T \le T_M$

Case 2: When $t_\omega \le T_M \le T$;

The graphical description of these two cases is shown in figures 1 and 2.

Case 1: If $T \le T_M$ (see figure 1) at that point, the delay period (T_M) is to purchasing is more than the cycle length (T). In this manner, the client produces the income, and there is no interest charged.

The complete interest earned in the existing case is

$$\boldsymbol{IE_1 = I_e\left[\int_0^T tD(t) e^{-I_r t} dt + (T_M - T)\int_0^T D(t) e^{-I_r t} dt\right]}$$

$$\boldsymbol{IE_1 = I_e\left[\frac{\psi^T e^{-I_r T}}{I_r - log\psi}\left\{\frac{2\alpha T}{I_r - log\psi} - \alpha T^2 - 2\alpha\right\} + (T_M - T)\alpha\left\{\frac{1}{I_r - log\psi} - \frac{\psi^T e^{-I_r T}}{I_r - log\psi}\right\}\right]} \tag{7}$$

Hence, the complete appropriate cost / cycle is

$$\boldsymbol{TC_1 = \frac{1}{T}[SC + PC + C + IDP + AC - IE_1]} \tag{8}$$

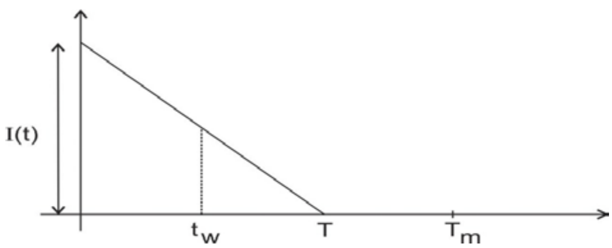

Figure 1. ($T \le T_M$) Graphical Representation of case 1.

Case2: If $t_w \le T_m \le T$ (see figure 2), at that point the delay period is smaller than the complete cycle length. Along these lines, the customer must pay interest charged on unsold level of stock that is following this; the absolute interest received is characterized as

$$\boldsymbol{IP = I_c \int_{T_M}^{T} I_2(t)\, e^{-I_r t} dt}$$

$$\boldsymbol{IP = I_c\left[\frac{\alpha}{\omega e^{-q\xi} + log\psi}\left\{\frac{\psi^{T_M}(1-T_M) e^{-I_r T_M}}{I_r - log\psi} - \frac{\psi^T (1-T) e^{-I_r T}}{I_r - log\psi} + \frac{\psi^{T_M} e^{-I_r T_M}}{(I_r - log\psi)^2} - \frac{\psi^T e^{-I_r T}}{(I_r - log\psi)^2}\right\} + \frac{(1-T)}{I_r}\left\{e^{-I_r T_M} - e^{-I_r T}\right\}\right.} \tag{9}$$

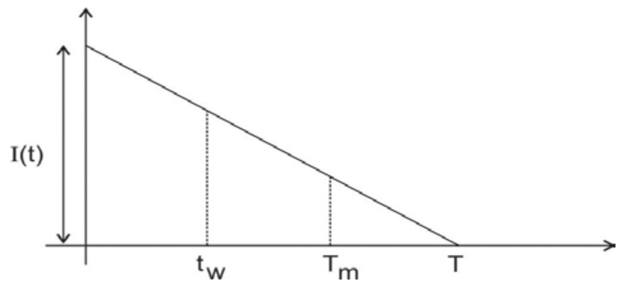

Figure 2. ($t_\omega \le T_M \le T$) Graphical Representation of case 2.

Now, the interest earned is as follows:

$$IE_2 = I_e \int_{T_M}^{T} D(t) t e^{-I_r t} dt$$

$$= I_e \alpha \left[\left\{ \frac{T_M^2 \psi^{T_M} e^{-rT_M}}{I_r - log\psi} - \frac{T^2 \psi^T e^{-rT}}{I_r - log\psi} \right\} - \frac{2}{I_r - log\psi} \left\{ \frac{T_M \psi^{T_M} e^{-rT_M}}{I_r - log\psi} - \frac{T\psi^T e^{-rT}}{I_r - log\psi} \right\} - \frac{2}{I_r - log\psi} \left\{ \frac{\psi^{T_M} e^{-rT}}{I_r - log\psi} - \frac{\psi^T e^{-rT_M}}{I_r - log\psi} \right\} \right] \quad (10)$$

The total appropriate cost per cycle is defined as,

$$TC_2 = [SC + PC + C + IDP + AC + IP - IE_2]$$

The essential objective of this examination is to find the ideal estimations of cost work with choice variable (request level Q, the complete cycle length T).

3. Numerical Illustration

The proposed model is verified numerically and thus we consider the values of the following different parameters as:

Advertisement factor $\psi = 0.2$ Selling using with advertisement parameter in demand $\alpha = 30$; Production cost parameter b=2, 0 < b; Process reliability factor $r = 0.07; 0 < r < 1$; Holding cost parameter h = 0.011; Preservation cost parameter q =50; Deterioration rate $\omega = 0.05$; Preservation cost variable $\xi = 12.5$; Depreciation shape parameters $\delta = 2.5$, $\epsilon = 5$; Depreciation parameter $\mu = 50$; Rate of inflation $I_r = 0.02$; Interest earns $I_e = 0.18$; Interest charge $I_c = 0.2$; $C_\psi = 50$; $t_\omega = 0.002$; Setup cost $C_0 = 100$; Production cost $C_p = 20$; Holding cost $C_h = h.C_p$; Reliability factor use in depreciation $r = 0.52$; Permissible delay period $T_M = 0.03$.

Decision Variable: order level *Q*, the total cycle length *T*

Case 1: To minimize the total average cost per unit time, the optimal values of Q and T obtained by solving the following two equations simultaneously as, $\partial TC_1(Q,T)/\partial Q = 0$ and $\partial TC_1(Q,T)/\partial T = 0$; provided they satisfy the sufficient conditions for (Q,T).

$\partial^2 TC_1(Q,T)/\partial Q^2 > 0$, $\partial^2 TC_1(Q,T)/\partial T^2 > 0$ and $(\partial^2 TC_1(Q,T)/\partial Q^2)\,(\partial^2 TC_1(Q,T)/\partial T^2) - (\partial^2 TC_1(Q,T)/\partial Q \partial T) > 0$

Case 2: To minimize the total average cost per unit time, the optimal values of Q and T obtained by solving the following two equations simultaneously as,

$\partial TC_2(Q,T)/\partial Q = 0$ and $\partial TC_2(Q,T)/\partial T = 0$; provided they satisfy the sufficient conditions for (Q,T).

$\partial^2 TC_2(Q,T)/\partial Q^2 > 0$, $\partial^2 TC_2(Q,T)/\partial T^2 > 0$ and $(\partial^2 TC_2(Q,T)/\partial Q^2)\,(\partial^2 TC_2(Q,T)/\partial T^2) - (\partial^2 TC_2(Q,T)/\partial Q \partial T) > 0$

Table 1. The calculated total average cost for case 1 and 2.

	TC	Q	T
Case 1($T < T_M$)	12.4	12.813	17.175
Case2 ($t_\omega \le T_M \le T$)	12.0896	26.9231	26.4862

The total average cost for both cases 1 and 2 is shown in table 1.

4. Sensitivity Analysis

There are two cases as indicated by the permissible delay period and are represented in the form of table as follows:

Table 2. Case 1 for $T < T_M$

ψ (Advertisement factor)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	11.5864	11.9635	12.2667	12.4	12.5233	12.7472	12.9469
Q	13.2681	13.054	12.8859	12.813	12.7445	12.6203	12.5079
T	19.0992	18.1746	17.4725	17.175	16.903	16.4217	16.0034
α (Selling using with advertisement parameter in demand)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	9.03366	10.5935	11.8506	12.4	12.907	13.8181	14.618
Q	14.7131	13.5662	12.9988	12.813	12.6664	12.4561	12.3188
T	27.1915	21.5145	18.3211	17.175	16.2189	14.7079	13.5582
b (Production cost parameter)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	-3.1407	7.05901	10.6179	12.4	14.1839	17.7577	21.3353
Q	5.67179×10^{47}	22.4642	14.9392	12.813	11.2099	8.94549	7.41749
T	3.39099×10^{47}	28.9939	19.8371	17.175	15.1486	12.2603	10.2959
γ(Production cost parameter)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	13.7188	13.263	12.7084	12.4	12.0722	11.3647	10.5915
Q	4.72808	7.38305	10.7593	12.813	15.1816	21.1973	29.8492
T	13.9835	15.0301	16.3691	17.175	18.0919	20.3617	23.4957
C_ψ							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.3706	12.3823	12.3939	12.4	12.4056	12.4172	12.4288
Q	12.7348	12.7659	12.797	12.813	12.8282	12.8594	12.8906
T	17.115	17.1388	17.1626	17.175	17.1864	17.2103	17.2341
fixed lifetime (t_ω)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.3761	12.3766	12.3771	12.377	12.3776	12.3782	12.3787
Q	12.7055	12.7078	12.7102	12.711	12.7125	12.7148	12.7172
T	17.0997	17.1013	17.103	17.104	17.1046	17.1062	17.1078
C_0 (Setup cost)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	8.76135	10.4069	11.7713	12.377	12.9426	13.9707	14.8868
Q	5.6826	8.31335	11.1854	12.711	14.2983	17.6618	21.2938
T	10.9068	13.4648	15.9066	17.104	18.2926	20.6627	23.0476
T_m (Permissible delay Time)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.3746	12.3757	12.3768	12.377	12.3779	12.379	12.3801
Q	12.704	12.7069	12.7099	12.711	12.7128	12.7157	12.7187
T	17.0982	17.1004	17.1027	17.104	17.1049	17.1072	17.1094

For case 1, the values are also depicted graphically in figures 3 to 10. The figure 3 represents the effect of effect of percentage in the advertisement factor. Similarly, figures 4 to 10 represent the effect of percentage change in selling price per item, the effect of percentage change in production cost, the effect of percentage change in advertisement cost / advertisement, the effect of percentage change in fixed lifetime of the item, the effect of percentage change in the set-up cost and the effect of percentage change in delay payment period, respectively.

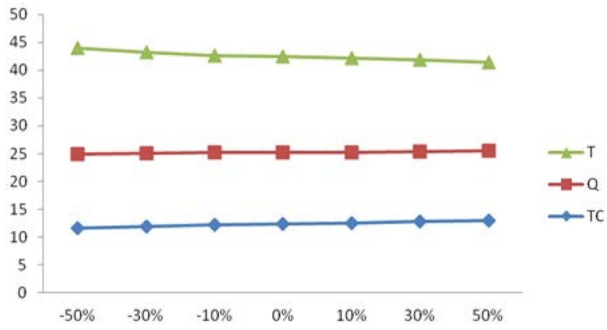

Figure 3. (Effect of % change in ψ)

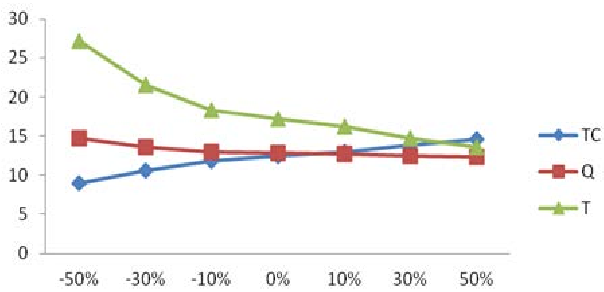

Figure 4. (Effect of % change in α)

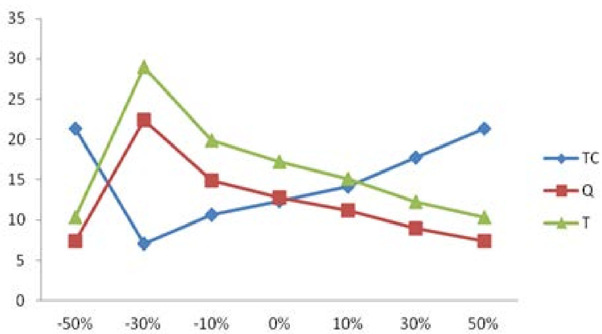

Figure 5. (Effect of % change in b)

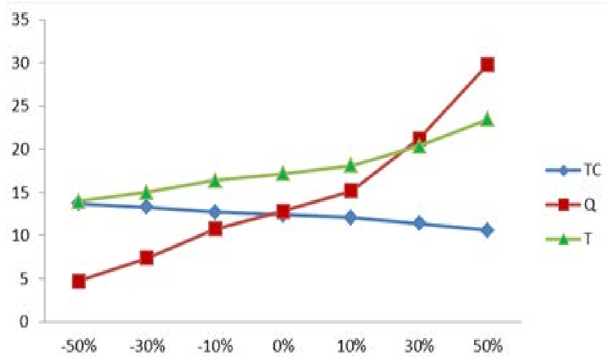

Figure 6. (Effect of % change in γ)

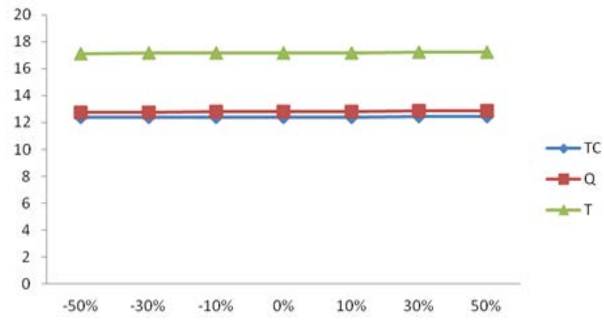

Figure 7. (Effect of % change in C_ψ)

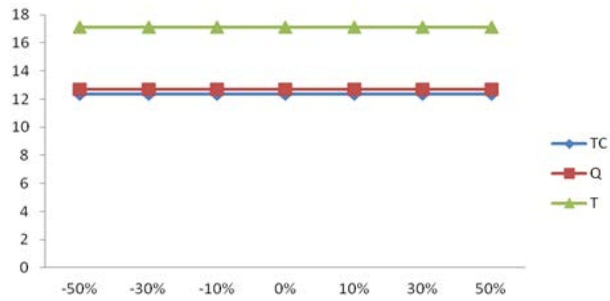

Figure 8. (Effect of % change in t_ω)

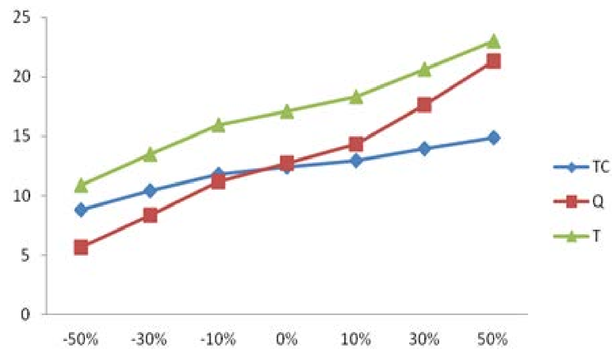

Figure 9. (Effect of % change in C_0)

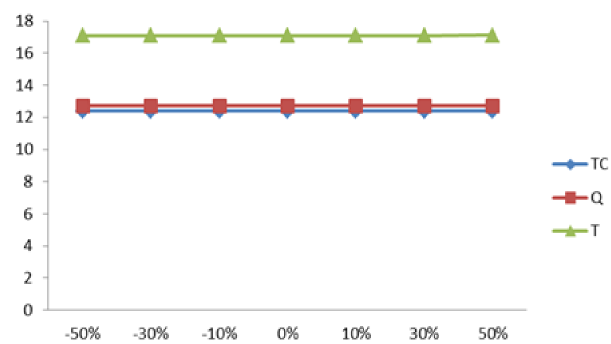

Figure 10. (Effect of % change in T_m)

Table 3. Case 2: $(t_\omega \le T_M \le T)$

ψ (Advertisement factor)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.1718	11.1718	11.8141	12.0896	12.3428	12.797	13.1978
Q	40.5051	34.5051	28.6909	26.9231	25.5269	23.4184	21.8635
T	38.3455	32.3455	27.9281	26.4862	25.3104	23.4691	22.0588
α (Selling using with advertisement parameter in demand)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	14.9544	13.9544	10.9544	12.0896	13.0965	14.8668	16.4146
Q	35.2754	36.2754	36.2754	26.9231	22.8134	18.6732	16.4983
T	32.725	33.725	33.725	26.4862	22.773	18.5144	15.9828
b (Production cost parameter)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	14.2909	18.3545	22.2075	12.0896	14.2909	18.3545	22.2075
Q	18.1108	11.5261	8.60688	26.9231	18.1108	11.5261	8.60688
T	19.9163	14.1146	11.167	26.4862	19.9163	14.1146	11.167
γ (Production cost parameter)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	14.0572	13.4123	12.5858	12.0896	11.5078	14.0572	13.4123
Q	6.60982	11.3585	19.5492	26.9231	42.5133	6.60982	11.3585
T	16.7885	19.1157	23.0551	26.4862	33.4841	16.7885	19.1157
C_ψ							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.0707	12.0783	12.0858	12.0896	12.0934	12.1009	12.1084
Q	26.6728	26.7726	26.8728	26.9231	26.9734	27.0743	27.1755
T	26.3385	26.3975	26.4566	26.4862	26.5158	26.5752	26.6346
t_ω							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.0838	12.0862	12.0885	12.0896	12.0907	12.0929	12.095
Q	26.7734	26.8339	26.8936	26.9231	26.9523	27.0102	27.0672
T	26.3983	26.4339	26.4689	26.4862	26.5034	26.5374	26.5709
C_0 (Setup cost)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	9.50257	10.7376	11.6901	12.0896	12.4468	13.0472	9.50257
Q	8.94424	14.7699	22.2799	26.9231	32.4345	48.459	345
T	14.0165	18.6308	23.6678	26.4862	29.6361	38.0164	138
T_M (Permissible delay Time)							
% Change	-50%	-30%	-10%	0%	10%	30%	50%
TC	12.0764	12.0817	12.087	12.0896	12.0922	12.0973	12.1023
Q	26.757	26.8244	26.8905	26.9231	26.9554	27.019	27.0815
T	26.3883	26.428	26.467	26.4862	26.5052	26.5427	26.5794

For case 2, the values are also depicted graphically in figures 11 to 17. The figure 11 represents the effect of effect of percentage in the advertisement factor. Similarly, figures 12 to 17 represent the effect of percentage change in selling price per item, the effect of percentage change in production cost, the effect of percentage change in advertisement cost / advertisement, the effect of percentage change in fixed lifetime of the item, the effect of percentage change in the set-up cost and the effect of percentage change in delay payment period, respectively.

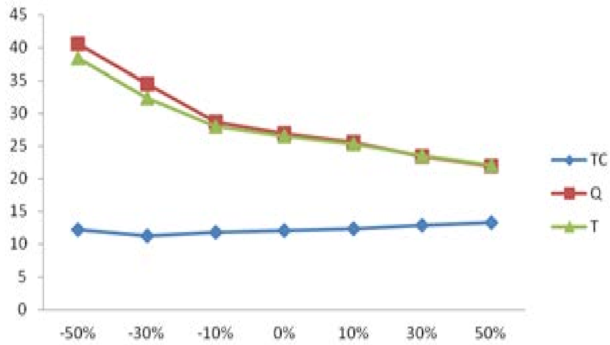

Figure 11. (Effect of % change in ψ)

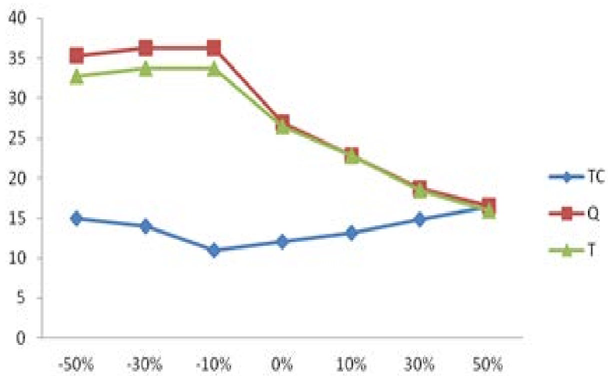

Figure 12. (Effect of % change in α)

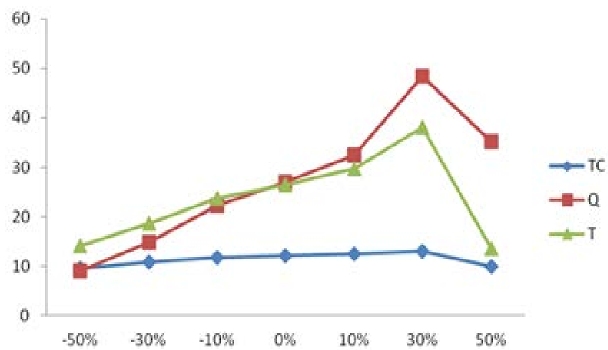

Figure 13. (Effect of % change in b)

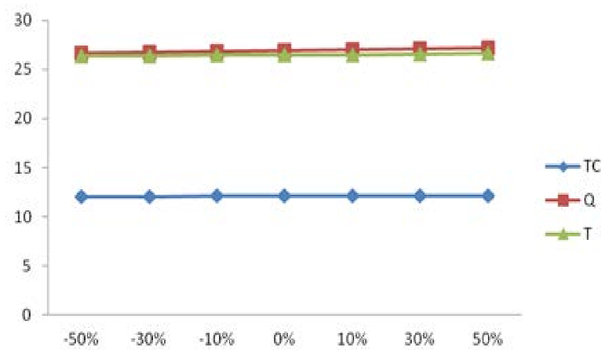

Figure 14. (Effect of % change in C_ψ)

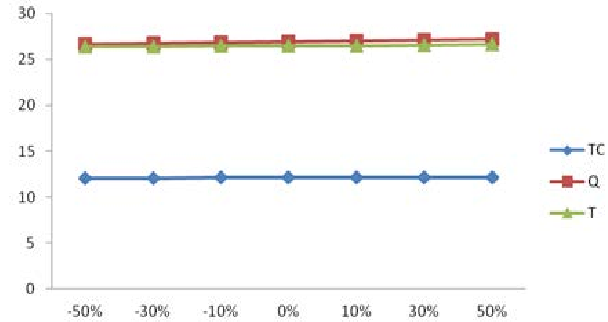

Figure 15. (Effect of % change in t_ω)

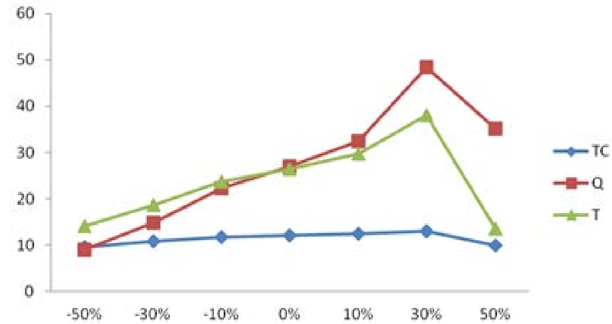

Figure 16. (Effect of % change in C_0)

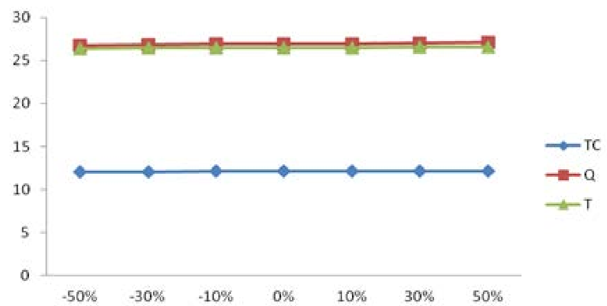

Figure 17. (Effect of % change in t_m)

5. Discussion

From the table 2 the effect of changes in the parameters ψ, ε, b, γ, C_ψ, t_w, C_0 and T_m on the optimum total cost is shown. The sensitive analysis is performed by changing each of the parameters by 50%, 30%, 10%, -50%, -30% and -10% and taking one parameter at a time and keeping the other parameters unchanged. Thus, we obtain the following observations:

1. If the advertisement factor (ψ) changes, then the total cost (TC) slightly decreases linearly while T and Q linearly increases (see figure 3).
2. If the selling price (α) changes, then the total cost increases upward while Q increases linearly, and T is decreased downward (see figure 4).
3. If the production cost parameter (b) changes, then the total cost increases upward while T and Q are decreasing downwards (See figure 5).

4. If γ changes, then the total cost (TC) linearly decreases downward while T and Q are increasing upward (see figure 6).
5. If the advertisement cost per advertisement (C_ψ) changes, then the total cost (TC) increases linearly while T and Q linearly increases (see figure 7).
6. If the fixed lifetime (t_ω) changes, then the total cost (TC) increases linearly, while T and Q are also linearly increasing (see figure 8).
7. If the set-up cost (C_0) changes, then the total cost (TC) increases upward while T and Q also increases upward (see figure 9).
8. If the permissible delay time (T_m) changes, then the total cost (TC) increases linearly while T and Q linearly rises (see figure 10).

From table 3, the effect of changes in the parameters ψ, ε, b, γ, $C\psi$, t_ω, C_0 and Tm on the optimal total cost for case 2 is presented. Thus, the following observations are:

1. If advertisement factor (ψ) changes, then the total cost (TC) increases linearly while T and Q decreases downward (see figure 11).
2. If the selling price (α) changes, then the total cost (TC) linearly increases upward while Q and T are decreasing downward (see figure 12).
3. If the production cost parameter (b) changes, then the total cost (TC) increases upward while T and Q decreases downwards (see figure 13).
4. If γ changes, then the total cost (TC) linearly decreases while T and Q increases upward (see figure 14).
5. If the advertisement cost per advertisement (C_ψ) changes, then the total cost (TC) increases linearly while T and Q linearly increases (see figure 15).
6. If the fixed lifetime (t_ω) changes, then the total cost (TC) increases linearly while T and Q also linearly increases (see figure 16).
7. If the set-up cost (C_0) changes, then the total cost (TC) increases while T and Q also increases upward and then decreases downward (see figure 17).

6. Conclusions

In this paper, we propose a manufacturing reliability inventory model in which demand depends on the factor's advertisement, time, and selling price. Here we consider lead time is zero, and shortages are not allowed. The manufacturing rate depends on the order level. In a real-life situation, the supplier offers a credit limit to the customer during there is no interest charged. Still, upon the expiry of the prescribed time limit, the supplier will charge some interest. The whole study is based on preservation techniques, trade credits, demand, inflation, and deterioration. A numerical example validates the proposed model, and the graphs are plotted, and its analysis is done. This model is useful in industries for the production of the food products and fashionable items, etc.

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