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An EPQ Model for Deteriorating Items with Advertisement and Selling Price dependent Demand under the Partial Trade Credit Policy

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Abstract

In this present research work, we developed an economic product quantity model for deteriorating items. In this model, we used the selling price and advertising-dependent demand function with the impact of the partial trade credit policy. The entire research work is carried out under the impact of inflation with different costs. The trade credit policy is applied in different cases and our main objective of this model is to get the maximum profit. To establish mathematical model numerical examples and sensitivity analysis solved for different cases. And optimum values of the decision parameters show the optimality of the model and the graphical part shows the concavity of the model.

Keywords: Deterioration, trade credit, inflation, selling price.

1. Introduction

The economic production quantity model is a simple mathematical model in the inventory control system that deals with inventory issues in the production system. And this model is ideal for the order size. EPQ models help to optimize maximum profits and reduce total costs. In the production system, many items start started decay, vaporize, spoil, and damage after a certain period due to weak quality production, environment, and many others. Such as vegetables, alcohol, medicines, natural products, fruits, flowers, etc. Due to deterioration, spoilage, and vaporization the real market value of the items and quality of items decrease. To reduce the deterioration many technologies are available in the market but some techniques are the best to provide the extra protection. Preservation technology, freezing systems, and warehouse systems are available in the market. All these technologies we can apply to provide extra protection to deteriorating items for the maximum life period. So applying all techniques producer organizations can get maximum profit. So, the trade credit system and profit are affected by these technologies. Simply we can define the trade credit. Trade credit means the exchange of products from the organization to the supplier and supplier to the wholesaler and wholesaler to the customer without case payment and advance payment. The wholesaler provides a delay in payment to his customers a few times. In this research, we have discussed the partial trade credit with the impact of inflation. In simple words, we can define inflation. Inflation means a hike and down the price value of money concerning time. Demand plays a vital role in the inventory system. So, demand depends on various factors like stock level, time, selling price, advertisement, inventory level, etc. In this work, demand functions are dependent on the selling price and advertisement.

Shah and Naik [1] presented an inventory model for bad-quality items. In this work, demand was dependent on time and price with a credit period. Two-level supply chain systems are also used between supplier and retailer with the impact of trade-credit policies. Mahata et al. [2] investigated the supply chain system between supplier-retailer-customer for deteriorating items and the deterioration type was non-instantaneous. And demand function was dependent on a credit period.

Bhuniya et al. [3] established two inventory models for deteriorating items, the first model was carried with selling price demand, green technology, and product quality. And second model was established with trade credit policy under the impact of inflation. Jani et al. [4] developed an inventory model for deteriorating items and they controlled deterioration by fresh quality items technology. This research work was dependent on deterioration with the effect of trade credit and shortages.

Mahato et al. [5] carried out a model for non-instantaneous deteriorating items with preservation technology. This model has been established with price-sensitive demand and time-varying deterioration rates under the impact of trade credit and carbon tax policy. Nigwal et al. [6] presented the EOQ model for imperfect quality products considering price-sensitive demand under the impact of trade credit policy.

Sharma et al. [7] investigated a sustainable inventory model including the manufacturing and remanufacturing process. In this model, the impact of carbon emissions and trade credit is also included. Singh and Rana [8] developed a mathematical model for fragment-quality items with the impact of inflation. In this research work, they worked on linear dependent demand function. And they permitted the shortages. Bhawaria and Rathore [9] studied an EPQ model for deteriorating items with preservation technology and the impact of inflation. In this model, the demand function used a hybrid type such as selling price and stock level dependent. They considered the impact of partial trade credit. In the same manner, many prominent researchers and authors worked on inflation and trade credit policy which are given in the table.

Authors	**EPQ/EOQ Model**	**Deterioration**	**Demand**	**Trade credit**	**Shortages**	**Supply chain**
Choudhury and Mahata [9]		Non-instantaneous	Price sensitive		Partial	
Shaikh et al.[10]	EPQ		Selling price	Partial		
Alamri [11]			Triangular fuzzy number			Fuzzy
Alamri et al. [12]	EOQ		Triangular fuzzy number			
Chandramohan et al. [13]		Non-instantaneous	Multi-variate	Multi		
Deb and Islam [14]	EOQ		Linearly related to time			
Ezimadu et al. [15]			Advertising			
In this work	EPQ		Advertisement and sellin	Partial		

			g price			

2. Notations and assumptions

2.1 Notations

I_i(t): Inventory level per unit, $0 \le \mathrm{t} \le \mathrm{T}$

P: Production rate per unit per unit time;

$D(A, s)$: Demand rate per unit per unit time;

M: Customer's trade credit time stored by retailer per unit time;

N: Retailer's trade credit time provided by supplier per unit time;

H: Holding cost per $ per unit per unit time;

S_C: Setup cost per $ per cycle;

θ: Deterioration rate, $0 \le \theta \le 1$;

C_R: Regular production cost per $ per unit;

r_C: The repairable cost per $ per unit;

r: Inflation rate per %;

S_R: The total sales revenue per unit;

R_r: Reliability rate to produce efficient goods per %;

β: The customer is to pay its retail trader when the order, $0 \le \beta \le 1$

I_E: Interest earned by retailer per $ per unit time;

I_S Interest paid by retailer per $ per unit time;

TP_i :(s, t_1, T): Total profit per $ per unit time;

t_1: Production time per unit time;

s: Selling price per $ per unit;

A: The advertisement frequency.

2.2 Assumptions

We assumed the following assumptions to develop the model these are as-

1. The trade credit policy is partial.
2. The lead time is zero.
3. The replacement is instantaneous.
4. The function is-
   $D(A, s) = A^a(\alpha - \beta s)$,
   Where a, α, $\beta > 0$
5. Shortages are not permissible.
6. Under the effect of inflation.
7. The deterioration rate is θ, $0 \le \theta \le 1$

3. Mathematical model formulation

At first, we assumed the stock level was zero. Then production starts and the inventory level reaches the maximum level after the Production stops. And inventory level decreases due to demand and deterioration and reaches zero level at t = 0. Here the demand is less than the production rate. Then the governing following differential equations in the interval [0, T].

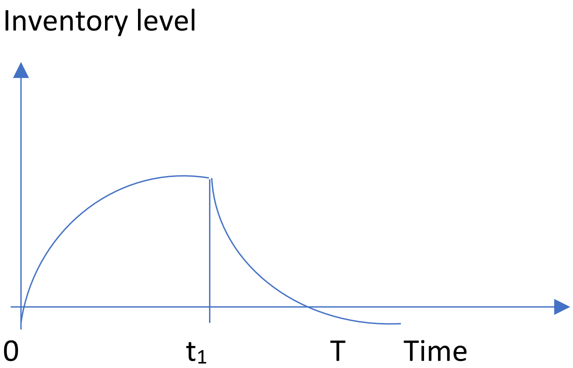

Fig.-1 Inventory functioning

The governing differential equations are given as

$$\frac{dI_1(t)}{dt} + \theta I_1(t) = PR_r - A^a(\alpha - \beta s), 0 \le t \le t_1 \quad (1)$$

$$\frac{dI_2(t)}{dt} + \theta I_2(t) = -A^a(\alpha - \beta s), t_1 \le t \le T \quad (2)$$

With the boundary condition $I_1(0) = 0$ and $I_2(T) = 0$

Solving equations (1) and (2) and using the above boundary condition we get

$I_1(t) = (\frac{PR_r - A^a(\alpha-\beta s)}{\theta})(1-e^{-\theta t})$
(3)

$I_2(t) = \frac{A^a(\alpha-\beta s)}{\theta}\left(e^{\theta(T-t)}-1\right)$
(4)

The given condition at t = $t_1$is continuous so

$$T = t_1 + \frac{1}{\theta}\log\left\{1+\frac{(PR_r - A^a(\alpha-\beta s))}{A^a(\alpha-\beta s)}\left(1-e^{-\theta t_1}\right)\right\} \quad (5)$$

1. **Cost Calculation**

The production cost

$C_R = cP\int_0^{t_1} e^{-rt}dt$

$C_R = \frac{cP}{r}(1-e^{-rt_1})$
(6)

The holding cost

$H = h\{\int_0^{t_1} I_1(t)e^{-rt}dt + \int_{t_1}^{T} I_2(t)e^{-rt}dt\}$

$H = h\frac{(PR_r - A^a(\alpha-\beta s))}{\theta}\left\{\frac{(1-e^{-rt_1})}{r} + \frac{(e^{-(\theta+r)t_1}-1)}{\theta+r}\right\} + h\frac{(A^a(\alpha-\beta s))}{\theta}\left\{\frac{(e^{-rT}-e^{-rt_1})}{r} + \frac{(e^{\theta(T-t_1)-rt_1}-e^{-rT})}{\theta+r}\right\}$
(7)

The repair cost of defective items

$r_C = C_D(1-R_r)TA^a(\alpha-\beta s)$
(8)

The setup cost

$S_C = C_0 e^{-rT}$
(9)

Total sales revenue

$S_R = sA^a(\alpha-\beta s)\int_0^T e^{-rt}\,dt$

$S_R = \frac{sA^a(\alpha-\beta s)}{r}(1-e^{-rT})$
(10)

Now the credit periods N (retailer's) and M (Customer's) then two conditions arise

Condition-1st When M < N

Condition-2nd When N < M

Condition-1st When M < N then four cases are possible.

Case-1st N ≤ t_1

Case-2nd t_1 < N ≤ T

Case-3rd M < T ≤ N

Case-4rt T ≤ M < N

Case-1st N ≤ t_1

The payable interest

$I_{P(11)} = cI_S\{\int_N^{t_1} I_1(t)e^{-rt}dt + \int_{t_1}^{T} I_2(t)e^{-rt}dt\}$

$I_{P(11)} = cI_S\left[\left\{\frac{(PR_r - A^a(\alpha-\beta s))}{\theta}\left(\frac{(e^{-rN}-e^{-rt_1})}{r} + \frac{(e^{-(\theta+r)t_1}-e^{-(\theta+r)N})}{\theta+r}\right)\right\} + \frac{(A^a(\alpha-\beta s))}{\theta}\left\{\frac{(e^{\theta(T-t_1)-rt_1}-e^{-rT})}{\theta+r} + \frac{(e^{-rT}-e^{-rt_1})}{r}\right\}\right]$
(11)

The interest earned

$I_{E(11)} = \left(A^a(\alpha-\beta s)\right)sI_E\{\gamma\int_0^M te^{-rt}dt + \int_M^N te^{-rt}dt\}$

$$I_{E(11)} = \left(A^a(\alpha-\beta s)\right)sI_E\left[\gamma\left\{\frac{Me^{-rM}}{-r} + \frac{(1-e^{-rM})}{r^2}\right\} + \frac{1}{r}(Me^{-rM}-Ne^{-rN}) + \frac{1}{r^2}(e^{-rM}-e^{-rN})\right] \quad (12)$$

Therefore, the total profit

$TP_1(s,t_1,T) = \frac{1}{T}\left(S_R + I_{E(11)} - C_R - H - r_C - S_C - I_{P(11)}\right)$
(13)

2. **Optimality condition**

To maximize the total profit concerning s, t_1, T. The optimal necessary conditions are-

$\frac{\partial TP_1(s,t_1,T)}{\partial s} = 0, \frac{\partial TP_1(s,t_1,T)}{\partial t_1} = 0, \frac{\partial TP_1(s,t_1,T)}{\partial T} = 0$

$\text{Det.}(H_1) > 0, \text{Det.}(H_2) > 0,$
$Det.(H_3) > 0.$

Where H_1, H_2, and H_3 are the principal minor of the Hessian matrix. For the total profit-

$$\begin{bmatrix} \frac{\partial^2 TP_1(s,t_1,T)}{\partial s^2} & \frac{\partial^2 TP_1(s,t_1,T)}{\partial s \partial t_1} & \frac{\partial^2 TP_1(s,t_1,T)}{\partial s \partial T} \\ \frac{\partial^2 TP_1(s,t_1,T)}{\partial t_1 \partial s} & \frac{\partial^2 TP_1(s,t_1,T)}{\partial {t_1}^2} & \frac{\partial^2 TP_1(s,t_1,T)}{\partial t_1 \partial T} \\ \frac{\partial^2 TP_1(s,t_1,T)}{\partial T \partial s} & \frac{\partial^2 TP_1(s,t_1,T)}{\partial T \partial t_1} & \frac{\partial^2 TP_1(s,t_1,T)}{\partial T^2} \end{bmatrix}$$

Numerical Illustration

We have taken the appropriate values of the parameters to get the profit.

I_E = \$0.1/\$/year, M = 0.05year, N = 0.1year, r = 0.06, β = 0.05, C_D = \$20/unit, C_0 = \$200, A = 10, a = 0.1, R_r = 0.6, α = 150, h = \$10/unit/year, C = \$50/unit, I_S = \$10/\$/year, P = 130 units/year, γ = 130 units/year.

The optimal values are-

t_1^* = 3.87281, T^* = 3.99204, s^* = 370.1027, TP_1^* = 28831.7

The Graphical presentation

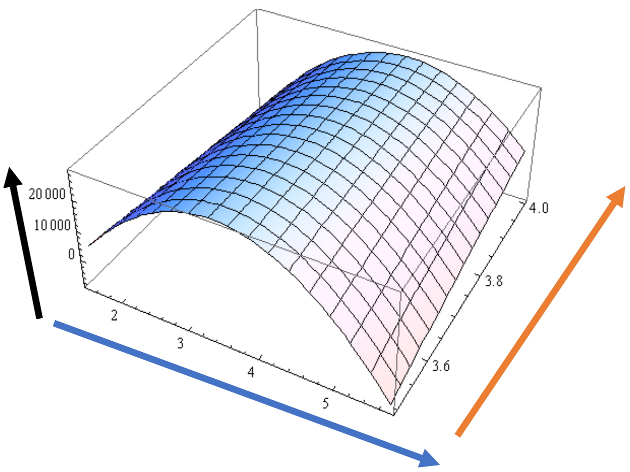

Fig. 2 Concavity graph w. r. t. t_1, T, and TP_1

Case 2: $t_1 < N \le T$

The payable interest

$$I_{P(12)} = CI_S \int_N^T I_2(t) e^{-rt} dt \quad (14)$$

$$I_{P(12)} = \frac{CI_S A^a(\alpha - \beta s)}{\theta} \left[\frac{e^{\theta T - (r+\theta)N} - e^{-rT}}{(r+\theta)} + \frac{e^{-rT} - e^{-rN}}{r} \right] \quad (15)$$

The interest earned

$$I_{E(12)} = sA^a(\alpha - \beta s) I_E [\gamma \int_0^M t e^{-rt} dt + \int_M^N t e^{-rt} dt] \quad (16)$$

$$I_{E(12)} = sA^a(\alpha - \beta s) I_E \left[\frac{\gamma M e^{-rM}}{-r} + \gamma \left(\frac{1 - e^{-rM}}{r^2} \right) + \left(\frac{Me^{-rM} - Ne^{-rN}}{r} \right) + \left(\frac{e^{-rM} - e^{-rN}}{r^2} \right) \right] \quad (17)$$

Therefore, the total profit

$$TP_2(s, t_1, T) = \frac{1}{T}\left(S_R + I_{E(12)} - C_R - H - r_C - S_C - I_{P(12)} \right)$$

Numerical Illustration

The following data was used.

I_E = \$0.0001/\$/year, M = 0.09year, N = 1.48year, r = 0.06, β = 0.2, C_D = \$20/unit, C_0 = \$200, A = 10, a = 0.03, R_r = 0.6, α = 150, h = \$10.5/unit/year, C = \$12.2/unit, I_S = \$140/\$/year, P = 70 units/year, γ = 130 units/year.

The optimal solutions are-

t_1^* = 0.872129, T^* = 1.48092, s^* = 378.308, TP_2^* = 28874.3

The Graphical presentation

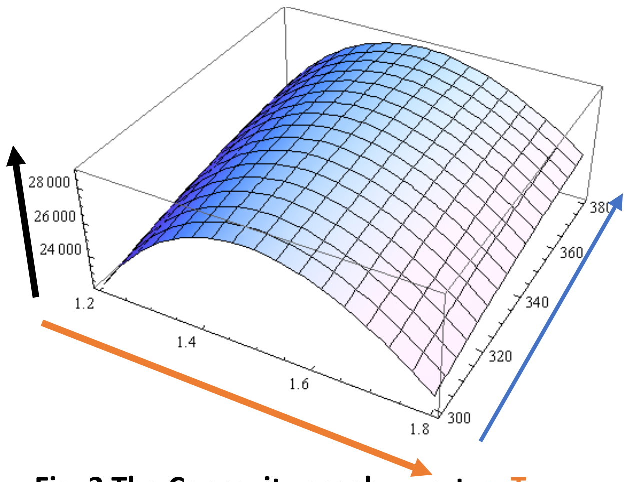

Fig. 3 The Concavity graph w. r. t. s, T, and TP_2

Case 3: M < T ≤ N

In this case payable interest

$$I_{P(13)} = 0 \quad (18)$$

The interest earned

$$I_{E(13)} = sA^a(\alpha - \beta s)I_E\left[\gamma \int_0^M te^{-rt}dt + \int_M^T te^{-rt}dt + T\int_T^N e^{-rt}\right] \quad (19)$$

$$I_{E(13)} = sA^a(\alpha - \beta s)I_E\left[\frac{-\gamma Me^{-rM}}{r} + \gamma\left(\frac{1-e^{-rM}}{r^2}\right) + \left(\frac{Me^{-rM} - Ne^{-rN}}{r}\right) + \left(\frac{e^{-rM} - e^{-rT}}{r^2}\right)\right]$$

(20)

Therefore, the total profit

$$TP_3(s, t_1, T) = \frac{1}{T}\left(S_R + I_{E(13)} - C_R - H - r_C - S_C - I_{P(13)}\right)$$

Numerical Illustration

The following data was used.

I_E = \$0.0001/\$/year, M = 0.09year, N = 1.48year, r = 0.06, β = 0.2, C_D = \$20/unit, C_0 = \$200, A = 10, a = 0.03, R_r = 0.6, α = 150, h = \$10.5/unit/year, C = \$12.2/unit, I_S = \$140/\$/year, P = 70 units/year, γ = 130 units/year.

The optimal solutions are-

t_1^* = 0.527013, T^* 1.30367, s^* = 379.654, TP^* = 28866.1

The Graphical presentation

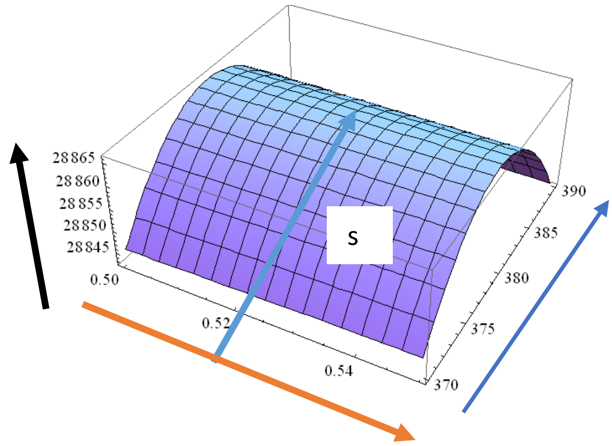

Fig. 4 The Concavity graph w. r. t. s, t_1, and TP_3

Case 4: T < M ≤ N

In this case payable interest

$$I_{P(14)} = 0$$
(21)

The interest earned

$$I_{E(14)} = sA^a(\alpha - \beta s)I_E\left[\gamma \int_0^T te^{-rt}dt + T\gamma\int_T^M e^{-rt}dt + T\int_M^N e^{-rt}\right] \quad (22)$$

$$I_{E(14)} = sA^a(\alpha - \beta s)I_E\left[\frac{-\gamma Te^{-rT}}{r} + \gamma\left(\frac{1-e^{-rT}}{r^2}\right) + T\gamma\left(\frac{e^{-rT} - e^{-rM}}{r}\right) + T\left(\frac{e^{-rM} - e^{-rN}}{r}\right)\right]$$
(23)

Therefore, the total profit

$$TP_4(s, t_1, T) = \frac{1}{T}\left(S_R + I_{E(14)} - C_R - H - r_C - S_C - I_{P(14)}\right)$$

Numerical Illustration

The following data was used.

I_E = \$0.0001/\$/year, M = 1.5 year, N = 1.6 year, r = 0.06, β = 0.2, C_D = \$20/unit, C_0 = \$200, A = 10, a = 0.03, R_r = 0.6, α = 150, h = \$10.5/unit/year, C = \$12.2/unit, I_S =

\$140/\$/year, P = 70 units/year, γ = 130 units/year.

The optimal solutions are-

$t_1^* = 0.52061$, $T^* = 1.30006$, $s^* = 379.59$, $TP_4^* = 29447.1$

The Graphical presentation

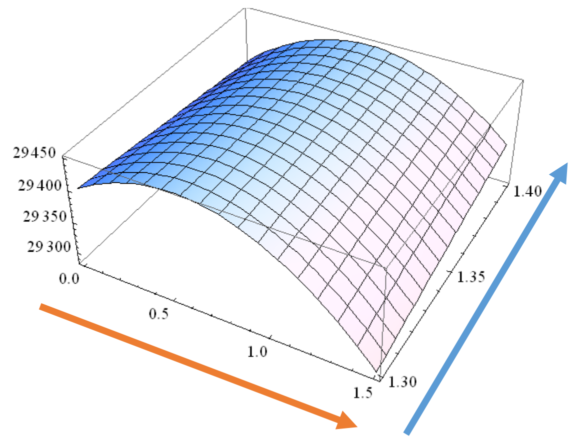

Fig. 5 The Concavity graph w. r. t. T, t_1, and TP_4

Condition-2 N < M

Case- 5 N < M ≤ t_1

Case- 6 t_1 < N < M ≤ T

Case- 7 T ≤ N < M

Case- 5 N < M ≤ t_1

In this case payable interest

$$I_{P(25)} = CI_S \int_N^{t_1} I_1(t)e^{-rt}dt + \int_{t_1}^{T} I_2(t)e^{-rt}dt \quad (24)$$

$$I_{P(25)} = CI_S\left[\left\{\frac{\left(PR_r - A^a(\alpha-\beta s)\right)}{\theta}\left(\frac{(e^{-rN}-e^{-rt_1})}{r} + \frac{(e^{-(\theta+r)t_1}-e^{-(\theta+r)N})}{\theta+r}\right)\right\} + \frac{(A^a(\alpha-\beta s))}{\theta}\left\{\frac{(e^{-rT}-e^{\theta(T-t_1)-rt_1})}{\theta+r} + \frac{(e^{-rT}-e^{-rt_1})}{r}\right\}\right] \quad (25)$$

The interest earned

$$I_{E(25)} = \left(A^a(\alpha-\beta s)\right)sI_E\gamma\int_0^N te^{-rt}dt \quad (26)$$

$$I_{E(25)} = \left(A^a(\alpha-\beta s)\right)sI_E\gamma N^2 \quad (27)$$

Therefore, the total profit

$$TP_5(s,t_1,T) = \frac{1}{T}\left(S_R + I_{E(25)} - C_R - H - r_C - S_C - I_{P(25)}\right)$$

Numerical Illustration

The following data was used.

I_E = \$0.07/\$/year, M = 1.481year, N = 1.48 year, r = 0.06, β = 1.3, C_D = \$25/unit, C_0 = \$170, A = 10, a = 0.0001, R_r = 0.7, α = 98, h = \$10/unit/year, C = \$10/unit, I_S = \$150/\$/year, P = 70 units/year, γ = 105 units/year, θ = 0.00001

The optimal solutions are-

$t_1^* = 1.47899$, $T^* = 1.4817$ T 7.7404, $TP_5^* = 30417.2$

The Graphical presentation

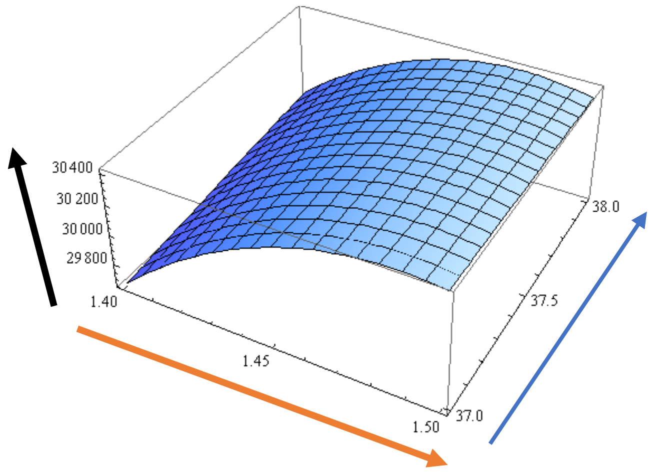

Fig. 6 The Concavity graph w. r. t. s, t_1, and TP_5

Case- 6 t_1 < N < M ≤ T

In this case payable interest

$$I_{P(26)} = CI_S\int_N^T I_2(t)e^{-rt}dt \quad (28)$$

$$I_{P(26)} = CI_S\frac{(A^a(\alpha-\beta s))}{2}(T-N)^2 \quad (29)$$

The interest earned

$$I_{E(26)} = \left(A^a(\alpha - \beta s)\right) s I_E \gamma \int_0^N t e^{-rt} dt$$ (30)

$$I_{E(26)} = \left(A^a(\alpha - \beta s)\right) s I_E \gamma N T$$ (31)

Therefore, the total profit

$$TP_6(s, t_1, T) = \frac{1}{T}\left(S_R + I_{E(26)} - C_R - H - r_C - S_C - I_{P(26)}\right)$$

Numerical Illustration

The following data was used.

I_E = \$0.01/\$/year, M = 2.199 year, N = 2.19 year, r = 0.06, β = 0.4, C_D = \$5/unit, C_0 = \$199, A = 10, a = 0.001, R_r = 0.38, α = 102, h = \$5/unit/year, C = \$3/unit, I_S = \$102/\$/year, P = 90 units/year, γ = 100 units/year, θ = 0.001

The optimal solutions are-

t_1^* = 1.77799 year, T^* = 2.1991, s^* = 127.455 TP_6^* = 20820.9

The Graphical presentation

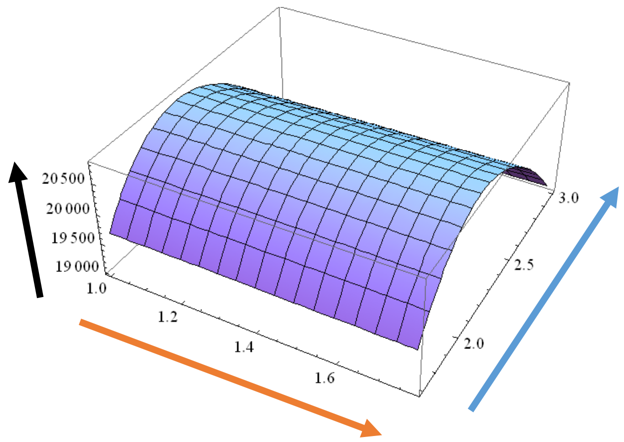

Fig. 7 The Concave graph w. r. t. T, t_1, and TP_6

Case- 7 T ≤ N < M

In this case payable interest

$$I_{P(27)} = 0$$ (31)

The interest earned

$$I_{E(27)} = \left(A^a(\alpha - \beta s)\right) s I_E \left[\gamma \int_0^T t e^{-rt} dt + T \int_T^N e^{-rt} dt\right]$$ (32)

$$I_{E(27)} = \left(A^a(\alpha - \beta s)\right) s I_E \left[(\gamma - 1)T^2 + TN\right]$$ (33)

Therefore, the total profit

$$TP_7(s, t_1, T) = \frac{1}{T}\left(S_R + I_{E(27)} - C_R - H - r_C - S_C - I_{P(27)}\right)$$

Numerical Illustration

The following data was used.

I_E = \$0.1/\$/year, M = 1.3 year, N = 0.91 year, r = 0.06, β = 1.3, C_D = \$82/unit, C_0 = \$100, A = 10, a = 0.01, R_r = 5.65, α = 57, h = \$39.7/unit/year, C = \$21/unit, I_S = \$100/\$/year, P = 90.1units/year, γ = 90 units/year, θ = 0.1

The optimal solutions are-

t_1^* = 0.00495856 year, T^* = 0.900596, s^* = 1.95779 TP_7^* = 21139.8

4. Sensitivity analysis

Table-1: Sensitivity analysis

S. No.	Parameters	Changes	t_1	T	s	TP_7
	C_0	99	0.00496606	0.900719	1.96029	21140.9
		100	0.00495856	0.900596	1.95779	21139.8
		101	0.00495105	0.900474	1.95528	21138.8
	r	0.05	0.00495856	0.900596	1.95779	21138.8
		0.06	0.00495856	0.900596	1.95779	21139.8

		0.07	0.00495856	0.900596	1.95779	21140.8
	A	9	0.00485422	0.900596	1.95802	21117.4
		10	0.00495856	0.900596	1.95779	21139.8
		11	0.00505304	0.900596	1.95758	21160.1
	a	0.009	0.00473067	0.900596	1.95829	21090.9
		0.010	0.00495856	0.900596	1.95779	21139.8
		0.020	0.00726682	0.900594	1.95272	21634.9
	C_D	81	0.00358376	0.888019	1.95697	20880.7
		82	0.00495856	0.900596	1.95779	21139.8
		83	0.00633331	0.913172	1.95857	21398.9
	R_r	5.64	0.00472446	0.898377	1.95761	21094.1
		5.65	0.00495856	0.900596	1.95779	21139.8
		5.66	0.00519183	0.902815	1.95797	21185.5
	α	56	0.00520992	0.919899	1.96297	20749.5
		57	0.00495856	0.900596	1.95779	21139.8
		58	0.00470719	0.881994	1.95260	21530.2

	N	0.90	0.00497036	0.900704	1.95779	21139.7
		0.91	0.00495856	0.900596	1.95779	21139.8
		0.92	0.00494675	0.900488	1.95778	21139.9
	I_s	0.099	0.0059851	0.910420	1.97829	21131.0
		0.100	0.00495856	0.900596	1.95779	21139.9
		0.101	0.0039527	0.890979	1.93769	21148.7
	h	39.6	0.00471911	0.900472	1.95331	21142.3
		39.7	0.00495856	0.900596	1.95779	21139.9
		39.8	0.00519683	0.900720	1.96227	21137.3

The Graphical presentation

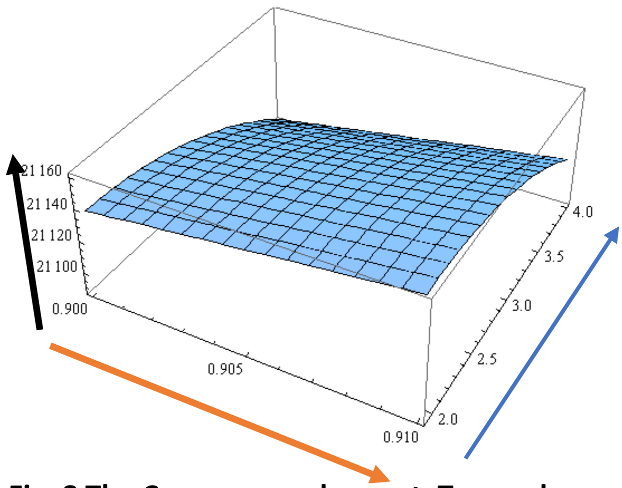

Fig. 8 The Concave graph w. r. t. T, s, and TP_7

Table 2 Analysis of the above table

No.	Parameters	Changes	t_1	T	s	TP_7
1	C_0	↑	↓	↓	↓	↓
		↓	↑	↑	↑	↑
2	r	↑	*	*	*	↑
		↓	*	*	*	↓
3	A	↑	↑	*	↓	↑
		↓	↓	*	↓	↑
4	a	↑	↑	↓	↓	↑
		↓	↓	↓	↑	↑
5	C_D	↑	↑	↑	↑	↑
		↓	↓	↓	↓	↓
6	R_r	↑	↑	↑	↑	↑
		↓	↓	↓	↓	↓
7	α	↑	↓	↓	↓	↑
		↓	↓	↑	↑	↑
8	N	↑	↓	↓	↓	↑
		↓	↓	↑	↑	↑
9	I_S	↑	↓	↓	↓	↑
		↓	↓	↑	↑	↑
10	h	↑	↑	↑	↑	↓
		↓	↑	↓	↓	↓

Note- Here upper arrow shows increment, the down arrow shows decrement, and * shows no changes.

5. Discussion

We studied an EPQ model for deteriorating products. There is an impact of inflation and partial trade credit policy carried out in this work and the impact is also seen in the sensitivity analysis. In this model, demand depends on selling price and advertisement which are highly affected in the inflationary environment. By the graph and analysis, we concluded that the profit arose for a time with selling price and advertisement-dependent demand. We calculated the total profit in different cases to analyze that in which case we got the maximum profit. To analyze this model we have calculated sensitive analysis and a graphical part showing maximum profit in different cases. In the future, this research work will extend with different demand patterns like in fuzzy environments, stock levels, and time-dependent demand. This research work fully trades credit policy with time-dependent deterioration and may give excellent results.

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