**Impact of Trade Credit Period and Inflation on an EOQ Model with Variable Holding Cost and Preservation Technology**

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**ABSTRACT**

The pricing, replenishment, and preservation methods of non-instantaneously decaying items are examined in this chapter as an investment problem. Preservation techniques influence both the length of the non-degradation period and the rate of deterioration. Backlogs and shortages in part are acceptable. We use a comprehensive framework with price-dependent and stock-dependent demand, time-varying deterioration, and waiting-time-dependent backlog rates to develop the model with time-dependent holding costs. We give an analytical proof of the existence and uniqueness of the optimal pricing, replenishment schedule, or preservation investment for any two of them in two situations. Moreover, we show that there exists a global replenishment policy for each given price and preservation investment plan.

**Keywords:** EOQ model, Inflation, Preservation Technology

**1. INTRODUCTION**

There are a lot of application of mathematic in various domains such as numerical analysis [1-7], control theory [8-10], approximation theory [11-12], inventory handling [13-14] etc. So, in this chapter, an investment dilemma including price, replenishment, and preservation technologies for non-instantaneously decaying products is examine. The duration of the non-degradation period and the pace of deterioration are both impacted by preservation methods. Partial backlogs and shortages are acceptable. To design the model with time dependent holding cost, we employ a broad framework that includes price-dependent and stock-dependent demand, time-varying degradation, and waiting-time-dependent backlog rates. We examine two scenarios: shortages occur either before to or after to the non-deterioration phase. In two scenarios, we provide an analytical demonstration of the existence and uniqueness of the best preservation investment, price, or replenishment schedule for any two of them. Furthermore, we demonstrate that for any given price and preservation investment strategy, there is a worldwide replenishment policy. Next, we offer an iterative approach for locating the best answer.

In inventory management, deterioration is a frequent occurrence, particularly in the food business. Due to spoiling, 20% of food never makes it to consumers' tables. According to Safeway grocery store, the food business accounts for 63% of supermarket trash disposed of in the United States, with each employee disposing of an average of 3,000 pounds of garbage yearly. Every food product ages to varying degrees as a result of chemical, physical, and microbiological changes. Fruits and vegetables are examples of food products that naturally deteriorate or decay. This is not an accident. The product breaks down as soon as it is harvested and keeps its intended quality characteristics for a time known as "shelf life". The term "non-deterioration period" refers to the amount of time during which none of the items in a batch require disposal.

The field of inventory management for decaying objects using preservation technologies is included in our chapter. Numerous studies have examined the inventory problem for deteriorating items under different market conditions, including those that focus on price dependence [15], time dependence [16], stock dependence [17], and so forth.

The paper "Pricing, replenishment, and Preservation Technology Investment Decisions for Non-instantaneous Deteriorating Items" [18] is expanded upon in this chapter. We continue the study in this chapter, treating demand as stock and price-dependent while keeping cost dependent on time and the impact of inflation.

In this chapter firstly, we described the notations and assumptions in section 2.2, in section 2.3 we gave mathematical formulation, in section 2.4 we gave cost components, in section 2.5 we gave total cost for inventory model, in section 2.6 we gave total average cost for the given model, in section 2.7 we gave solution process, in section 2.8 we gave numerical examples, in section 2.9 we gave behavior of optimum cost function with graphs, in section 2.10 we gave sensitivity analysis and at last in section 2.11 we gave conclusion to this model which we developed in this chapter.

2. **ASSUMPTIONS AND NOTATIONS**

This model is developed under the given assumptions and notations.

**Notations:** The summary of notations are as follows:

Qo Initial Inventory level.

T0 Non-deterioration period without preservation technology investment

Td  Non-deterioration period with preservation technology investment.

u Purchasing cost per unit.

p Retail price per unit.

D Variable demand rate.

P Coefficient of price dependent demand rate.

Q(t) Inventory level at time “t”

s Backlogged demand during shortage period.

λ Length of inventory holding period with shortage.

χ Preservation technology investment per unit time.

A Ordering cost for whole inventory.

T Length of replenishment cycle.

H Holding cost for whole inventory.

O Opportunity cost per unit lost sale.

r Rate of inflation 0<r<1.

s` Shortage cost per unit backordered item per unit.

β Backlogged coefficient 0<β<1.

δ Deterioration cost per unit per unit time.

θ Deterioration rate.

h1 ,h2 Non zero constants used in holding cost.

TP1 Total profit for one replenishment cycle. (λ1 ≥ Td)

TP2 Total profit for one replenishment cycle. (λ1 ≤ Td)

AP1 Average profit per unit time. (λ1 ≥ Td)

AP2 Average profit for per unit time. (λ1 ≤ Td)

M Proportion of reduced deterioration rate with preservation technolog Investment

**Assumptions:** The assumptions used in this chapter are as follows:

1. The demand rate of items is stock and price dependent .i.e. (D = a – b\*P + c\* Q(t))

Where a , b, c are non-zero constants.

2. The time horizon is infinite.

3. The Rate of deterioration is constant .

4. The holding cost varies with time.

5. Shortages are partially backlogged and are fulfilled at the beginning of the next cycle.

6. Replenishment rate is considered to be infinite.

7. Inflation is considered in this Model.

8. Lead time is considered to be negligible.

**3. MATHEMATICAL FORMULATION**

In case 1, As of the starting point, or t = 0, Q0 units of the item are in the inventory. The preservation technique is employed and degradation is not taken into account when t = 0 and Td. At t = Td to, degradation begins. t = scarcity happens after time.

In case 2, there are Q0 units of the item in the inventory at the starting state t = 0. In this instance, degradation is not taken into account. There is a shortage at time t = Td.

Time



0

T

-S

Inventory Level

λ1

Q0

-S

Time

Inventory level

Case:1

Case:2

Td

 λ 1

Q0

T

-S

0





**Case 1:** (λ1 ≥ Td)Differential equation for inventory level is given by` 

**Case 2:** (λ1 ≤ Td)Differential equation for inventory level is given by

**4. COSTS FOR THE INVENTORY PROBLEM**

**Case: 1** (λ1 ≥Td)When the period Td is equal to or greater than time λ1. These are the expenses:

**Sales revenue cost:**

Total revenue cost, sometimes referred to as sales revenue cost, is the amount of money received once inventory is sold. The cost formula is provided as follows.

**Fixed ordering:**

Fixed ordering cost is the amount of money required to order inventory materials. This expense is set, and let's say that it is 'A'.

**Holding cost**:

Holding cost is the amount of money required to keep the inventory. We regarded holding cost as time-dependent in this model as the following statement may be used to calculate holding cost:

**Preservation technology investment:**

Preservation technology investment is the sum of money required to stabilise the inventory preservation facility.

In this approach, the investment cost for preservation technologies is provided by ‘χλ1’.

**Purchasing cost:**

The purchasing cost is the total amount of money required to purchase inventory items. This total is the product of the original inventory level and the third-level inventory level, or "u" (buying cost per unit time). The following is the purchasing cost for the inventory model:

**Shortage cost:** Shortage cost is the amount of money lost as a result of an inventory shortfall. The following is the shortage cost for this model.

**Opportunity Cost:**

Opportunity cost or penalty cost is the sum of money that the innovator must pay as compensation for missing the deadline for fulfilling the demand. The following is the phrase for this cost:

**Deterioration cost:** Deterioration cost is the amount of money lost as a result of inventory damage or deterioration. The following is the phrase indicating diminishing cost:

**Costs for trade period:**

In this model we consider trade credit policy for both cases when trade period is less than to the period when inventory finished and when trade period is greater than to the period when inventory finished. The costs for both case are given as follows:

**Case 1: When (λ1 ≥ Td )**

**Subcase 1: When (M ≤ Td )** i.e. when trade period is less than to the period when inventory finished. Then cost for inventory model is given as follows:

 **Interest Earn ( I.E.):** The amount of money which is earned by retailor on the amount of inventory which is sold , will be come under this amount.

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**Interest Pay (I.P.):** Interest payments are calculated based on the amount that the store pays the loan agency. This is the sum that the retailer deducts from any external lending agency in order to pay the supplier since the trading period is shorter than the time at which all of the inventory is sold.

**Subcase 2: When (λ1 ≥ M ≥ Td )**

**Interest Earn (I.E.):**

**Interest Pay (I.P.):**

**Subcase 3: When (T ≤ M)**

**Interest Pay (I.P.):** 0

**Interest Earn (I.E.):**

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**Case 2: When (λ1 ≤ Td )**

**Subcase 1: (M ≤ λ1)**

**Interest Earn (I.E):**

**Interest Pay (I.P.):**

**Subcase 2: (M ≥ T)**

**Interest Pay (I.P.):** 0

**Interest Earn (I.E.):**

**Case 2: (**≤ Td)When time λ1 is less than or equal to the time Td. The costs are as follows:

**Sales revenue cost:**

Total revenue cost, also referred to as sales revenue cost, is the amount of money received once inventory is sold. The following is the formula for the cost:

**Fixed ordering:**

Fixed ordering cost is the amount of money required to order inventory materials. This expense is set, and let's say that it is 'A'.

**Holding cost:**

Holding cost is the amount of money required to keep the inventory. Since holding cost was taken into account in this model as being time-dependent, the formulation for determining holding cost is as follows:

**Purchasing cost:**

The purchasing cost is the total amount of money required to purchase inventory items. This sum is determined by multiplying the inventory level in the initial state by "u," or the purchase cost per unit time. This model's purchase price is listed as follows:

**Preservation technology investment:**

Preserving technology investment refers to the sum of money required to stabilise the facility for inventory preservation.

In this approach, the cost of the preservation technology investment is provided by ‘χλ1’.

**Shortage cost:**

A shortage cost is the amount of money lost as a result of an inventory shortfall. The following is the shortage cost for this model:

**Opportunity Cost:**

Opportunity cost or penalty cost is the sum of money that the innovator must pay as compensation for missing the deadline for fulfilling the demand. The following is the phrase for this cost:

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**Total Inventory Costs for the Inventory Problem:** Total cost for inventory problem in both case are given as follows:

**Total cost (TP1 ) for case 1:**

Seles revenue cost - Fixed ordering cost - Purchasing cost- Holding cost - Preservation technology investment cost - Deterioration cost - Shortage cost - Opportunity cost.

**Total cost (TP2 ) for case 2:**

Seles revenue cost - Fixed ordering cost - Purchasing cost- Holding cost - Preservation

technology investment cost - Shortage cost - Opportunity cost.

**Total average cost for the inventory problem**

The total average cost for inventory problem is given by dividing the total inventory cost to the total time horizon ‘T’.

**Total average cost for case ‘1’**

**Total average cost for case ‘2’**

**5. SOLUTION PROCEDURE**

Our goal is to determine the optimal value of P, χ, T, and λ1 so that AP1 and AP2 are maximal. For this, we solve the non-linear programming issue using the bordered hessian matrix approach. The objective function depends on the following four factors. A 4\*4 order hessian matrix will result. Given that this is a maximizing issue, the bordered hessian matrix should be negative definite for optimality. This is the bordered hessian matrix that is provided:

The matrix provided is negative definite. Therefore, by taking the partial derivative of A.P. with respect to the parameters T, P, χ, λ1, optimality will be reached on its critical points.

That is,

This is an analytical approach to solving the problem, however, I used Mathematica to help me with all of the calculations and to create a numerical solution that is provided on the next page.

**6. NUMERICAL EXAMPLE**

**8.1** The numerical examples provide an illustration of the above-given result. We take a look at the following input data to demonstrate the model.

Let a=70, b=1.8, c=0.25, s=30, o=0.55, u=0.42, A=350, r=0.45, β=0.095, γ=0.75, δ=0.45, θ=0.4, To=1.8, h1=1.1, h2=1.92, m=1-e-χγ, Td= To+β(1- e-χδ)

Answer: Applying the solution process of the given last section for case 2, we get the

following results, T=2, P=45, TP2=1362.99, λ1=1.

**8.2** Same example for case 2 is given as:

Let a=70, b=1.8, c=0.25, s=30, o=0.55, u=0.42, A=350, r=0.45, β=0.095, γ=0.75, δ=0.45, θ=0.4, To=1.8, h1=1.1, h2=1.92.

Answer: Applying the solution process of the given last section for case 2, we get the

following results, T=3, P=95, TP2=66.4215, λ1=0.5.

**Behavior of optimum cost function:**

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Preservation technology investment

Time

Profit

**7. SENSITIVITY ANALYSIS**

We conduct a sensitivity analysis for a few parameters to evaluate how the values of the parameters impact the ideal solution. Certain parameter values dropped to -5%, -10%, -15%, and -20% before rising to 5%, 10%, 15%, and 20%.

**7.1 Sensitivity analysis for parameter ‘h1’:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  **h1**  |  T |  P  |   |    |    |
| 1.320 | 2.0001 | 45.0013 |  0.9998  | 4.9998 | 1475.39 |
| 1.265 | 2.0002 | 45.0011 |  0.9999  | 4.9999 | 1447.29 |
| 1.210 | 2.0001 | 45.0010 |  0.9997  | 4.9999 | 1419.19 |
| 1.155 | 2.0003 | 45.0009 |  0.9999  | 4.9998 | 1391.09 |
| 1.100 | 2.0015 | 45.0011 |  0.9999  | 4.9999 | 1362.99 |
| 1.045 | 2.0011 | 45.0012 |  0.9995  | 4.9998 | 1334.88 |
| 0.990 | 2.0001 | 45.0010 |  0.9999  | 4.9999 | 1306.78 |
| 0.935 | 2.0000 | 45.0000 |  0.9999  | 4.9999 | 1278.67 |
| 0.880 | 2.0000 | 45.0000 |  0.9996  | 4.9998 | 1250.57 |

**7.2 Sensitivity analysis for parameter** ‘**h2’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **h2**  |  T |  P  |   |    |    |
| 2.304  | 2.0001 | 45.0008 |  0.9996  | 4.9998 | 1460.00 |
| 2.208 | 2.0002 | 45.0007 |  0.9999  | 4.9997 | 1435.74 |
| 2.112 | 2.0001 | 45.0006 |  0.9999  | 4.9999 | 1411.49 |
| 2.016 | 2.0003 | 45.0009 |  0.9997  | 4.9997 | 1387.24 |
| 1.920 | 2.0002 | 45.0008 |  0.9999  | 4.9996 | 1362.99 |
| 1.824 | 2.0001 | 45.0007 |  0.9998  | 4.9999 | 1338.73 |
| 1.728 | 2.0004 | 45.0009 |  0.9999  | 4.9998 | 1314.48 |
| 1.632 | 2.0003 | 45.0008 |  0.9999  | 4.9999 | 1290.23 |
| 1.536 | 2.0002 | 45.0009 |  0.9998  | 4.9997 | 1265.95 |

**7.3 Sensitivity analysis for parameter ‘γ’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **γ**  |  T |  P  |   |    |    |
| 0.9000 | 2.0001 | 45.0011 |  0.9998  | 4.9998 | 1392.83 |
| 0.8625 | 2.0003 | 45.0010 |  0.9999  | 4.9999 | 1387.31 |
| 0.8250 | 2.0002 | 45.0015 |  0.9997  | 4.9999 | 1380.66 |
| 0.7875 | 2.0000 | 45.0018 |  0.9999  | 4.9997 | 1372.65 |
| 0.7500 | 2.0001 | 45.0009 |  0.9999  | 4.9996 | 1362.99 |
| 0.7125 | 2.0002 | 45.0017 |  0.9998  | 4.9998 | 1351.34 |
| 0.6750 | 2.0000 | 45.0011 |  0.9999  | 4.9999 | 1337.31 |
| 0.6375 | 2.0000 | 45.0010 |  0.9996  | 4.9997 | 1320.41 |
| 0.6000 | 2.0003 | 45.0009 |  0.9999  | 4.9999 | 1300.05 |

**7.4 Sensitivity analysis for parameter ‘β’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **β**  |  T |  P  |   |    |    |
| 0.11400 | 2.0010 | 45.0009 |  0.9998  | 4.9998 | 1464.44 |
| 0.10925 | 2.0020 | 45.0008 |  0.9999  | 4.9999 | 1439.01 |
| 0.10450 | 2.0009 | 45.0007 |  0.9997  | 4.9999 | 1413.62 |
| 0.09975 | 2.0010 | 45.0009 |  0.9999  | 4.9997 | 1388.28 |
| 0.09500 | 2.0010 | 45.0008 |  0.9996  | 4.9999 | 1362.98 |
| 0.09025 | 2.0009 | 45.0007 |  0.9999  | 4.9996 | 1337.74 |
| 0.08550 | 2.0018 | 45.0009 |  0.9997  | 4.9999 | 1312.54 |
| 0.08075 | 2.0011 | 45.0006 |  0.9999  | 4.9996 | 1287.39 |
| 0.07600 | 2.0009 | 45.0009 |  0.9998  | 4.9998 | 1262.29 |

**7.5 Sensitivity analysis for parameter ‘r’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **r**  |  T |  P  |   |    |    |
| 0.5400 | 2.0001 | 45.0010 |  0.9998  | 4.9999 | 1381.20 |
| 0.5175 | 2.0002 | 45.0020 |  0.9999  | 4.9998 | 1376.65 |
| 0.4950 | 2.0001 | 45.0010 |  0.9997  | 4.9999 | 1372.09 |
| 0.4725 | 2.0001 | 45.0030 |  0.9998  | 4.9999 | 1367.54 |
| 0.4500 | 2.0000 | 45.0020 |  0.9997  | 4.9999 | 1362.98 |
| 0.4275 | 2.0002 | 45.0000 |  0.9997  | 4.9997 | 1358.43 |
| 0.4050 | 2.0001 | 45.0020 |  0.9999  | 4.9999 | 1353.88 |
| 0.3825 | 2.0000 | 45.0010 |  0.9996  | 4.9999 | 1349.32 |
| 0.3600 | 2.0000 | 45.0030 |  0.9999  | 4.9996 | 1344.77 |

**7.6 Sensitivity analysis for parameter ‘a’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **a**  |  T |  P  |   |    |    |
|  264 | 2.0001 | 45.0010 |  0.9998  | 4.9997 | 1850.10 |
|  253 | 2.0002 | 45.0020 |  0.9999  | 4.9999 | 1728.33 |
|  242 | 2.0000 | 45.0010 |  0.9997  | 4.9999 | 1606.54 |
|  231 | 2.0001 | 45.0009 |  0.9999  | 4.9998 | 1484.76 |
|  220 | 2.0003 | 45.0030 |  0.9999  | 4.9998 | 1362.98 |
|  209 | 2.0000 | 45.0040 |  0.9996  | 4.9999 | 1241.20 |
|  198 | 2.0000 | 45.0010 |  0.9998  | 4.9998 | 1119.42 |
|  187 | 2.0002 | 45.0030 |  0.9999  | 4.9997 | 997.64 |
|  176 | 2.0001 | 45.0020 |  0.9997  | 4.9998 | 875.86 |

**7.7 Sensitivity analysis for parameter ‘b’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **b**  |  T |  P  |   |    |    |
|  2.16 | 2.0001 | 45.0002 |  0.9998  | 4.9996 | 1183.64 |
|  2.07 | 2.0002 | 45.0000 |  0.9999  | 4.9999 | 1228.47 |
|  1.98 | 2.0001 | 45.0001 |  0.9996  | 4.9997 | 1273.31 |
|  1.89 | 2.0000 | 45.0000 |  0.9999  | 4.9998 | 1318.14 |
|  1.80 | 2.0003 | 45.0003 |  0.9996  | 4.9999 | 1362.98 |
|  1.71 | 2.0002 | 45.0000 |  0.9999  | 4.9997 | 1407.82 |
|  1.62 | 2.0000 | 45.0002 |  0.9995  | 4.9999 | 1452.60 |
|  1.53 | 2.0002 | 45.0000 |  0.9999  | 4.9998 | 1497.49 |
|  1.44 | 2.0003 | 45.0001 |  0.9998  | 4.9999 | 1542.34 |

**7.8 Sensitivity analysis for parameter ‘c’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **c**  |  T |  P  |   |    |    |
| 0.2890 | 2.0001 | 45.0020 |  0.9998  | 4.9995 | 1323.93 |
| 0.2875 | 2.0000 | 45.0030 |  0.9999  | 4.9999 | 1325.43 |
| 0.2750  | 2.0002 | 45.0010 |  0.9999  | 4.9994 | 1337.99 |
| 0.2625 | 2.0000 | 45.0040 |  0.9997  | 4.9999 | 1350.50 |
| 0.2500 | 2.0000 | 45.0020 |  0.9996  | 4.9999 | 1362.99 |
| 0.2375 | 2.0004 | 45.0030 |  0.9999  | 4.9999 | 1375.43 |
| 0.2250 | 2.0000 | 45.0040 |  0.9997  | 4.9995 | 1387.85 |
| 0.2125 | 2.0001 | 45.0020 |  0.9999  | 4.9999 | 1400.22 |
| 0.2000 | 2.0002 | 45.0030 |  0.9998  | 4.9998 | 1412.56 |

**7.9 Sensitivity analysis for parameter ‘θ’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **θ**  |  T |  P  |   |    |    |
|  0.48 | 2.0001 | 45.0011 |  0.9998  | 4.9999 | 1371.24 |
|  0.46 | 2.0000 | 45.0013 |  0.9997  | 4.9995 | 1369.25 |
|  0.44 | 2.0002 | 45.0010 |  0.9998  | 4.9999 | 1367.19 |
|  0.42 | 2.0003 | 45.0011 |  0.9997  | 4.9996 | 1365.10 |
|  0.40 | 2.0000 | 45.0010 |  0.9996  | 4.9999 | 1362.99 |
|  0.38 | 2.0001 | 45.0012 |  0.9999  | 4.9997 | 1360.84 |
|  0.36 | 2.0000 | 45.0014 |  0.9997  | 4.9999 | 1358.66 |
|  0.34 | 2.0003 | 45.0010 |  0.9999  | 4.9999 | 1356.45 |
|  0.32 | 2.0002 | 45.0013 |  0.9998  | 4.9998 | 1354.21 |

**7.10 Sensitivity analysis for parameter ‘A’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   **A**  |  T |  P  |   |    |    |
| 418.80 | 2.0001 | 45.0010 |  0.9997  | 4.9996 | 1328.59 |
| 401.60 | 2.0003 | 45.0020 |  0.9999  | 4.9999 | 1337.19 |
| 384.40 | 2.0002 | 45.0010 |  0.9998  | 4.9997 | 1345.79 |
| 367.20 | 2.0001 | 45.0015 |  0.9999  | 4.9999 | 1354.39 |
| 350.00 | 2.0000 | 45.0018 |  0.9997  | 4.9998 | 1362.98 |
| 332.80 | 2.0003 | 45.0023 |  0.9999  | 4.9999 | 1371.59 |
| 316.60 | 2.0002 | 45.0021 |  0.9999  | 4.9996 | 1379.69 |
| 309.40 | 2.0000 | 45.0019 |  0.9997  | 4.9999 | 1383.29 |
| 292.20 | 2.0001 | 45.0018 |  0.9998  | 4.9997 | 1391.89 |

**7.11 Sensitivity analysis for parameter ‘δ’**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  δ |  T |  P  |   |    |    |
| 0.5400 | 2.0001 | 45.0030 |  0.9996  | 4.9995 | 1381.20 |
| 0.5175 | 2.0000 | 45.0025 |  0.9999  | 4.9999 | 1376.65 |
| 0.4950 | 2.0002 | 45.0020 |  0.9995  | 4.9994 | 1372.09 |
| 0.4725 | 2.0000 | 45.0040 |  0.9999  | 4.9999 | 1367.54 |
| 0.4500 | 2.0003 | 45.0030 |  0.9998  | 4.9996 | 1362.98 |
| 0.4275 | 2.0000 | 45.0018 |  0.9999  | 4.9999 | 1358.43 |
| 0.4050 | 2.0000 | 45.0020 |  0.9998  | 4.9995 | 1353.88 |
| 0.3825 | 2.0001 | 45.0030 |  0.9999  | 4.9999 | 1349.32 |
| 0.3600 | 2.0002 | 45.0025 |  0.9997  | 4.9996 | 1344.77 |

**8. Conclusion**

This chapter examines a retailer using a non-instantaneous degrading inventory system to address a combined pricing, ordering, and preservation technology investment dilemma. To lessen losses from degradation, the store makes investments in preservation technologies. As we said before, preservation technology may extend the time before degradation occurs as well as lower the pace of deterioration. We develop a mathematical model that includes partial backlogs in shortages, a time-varying degradation rate with time-varying holding costs, and price-dependent and stock demand rates. We describe the characteristics of the ideal resolution. Our numerical examples demonstrate that when the rate of degradation, ordering or purchasing costs, or holding costs are significant, it is best for the store to forego investing in preservation technologies.

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