CHAPTER 7

STOCHASTIC INVENTORY MODEL UNDER INFLATION AND PERMISSIBLE DELAY IN PAYMENT ALLOWING PARTIAL PAYMENT FOR TWO SUPPLIERS

CHAPTER 7

7.1. INTRODUCTION:

In this chapter, we have introduced the aspect of part payment. A part of the purchased cost is to be paid during the permissible delay period. What quantity of the part is to be paid and the time at which it has to be paid can be fixed up at the time of the deal of purchasing the goods. We have also introduced the effect of inflation and time value of money was investigated under given sets of inflation and discount rates.

7.2. NOTATIONS, ASSUMPTIONS AND MODEL:

The stochastic inventory model for two suppliers under inflation and permissible delay in payment allowing partial payment is developed on the basis of the following assumptions.

- Interest earned and interest charged is as follows.

(a) Interest earned on the entire amount up to time period T_{1i} is $dce^{Rt_1} T_{00} T_{1i} Ie_i$

(b) Interest earned on (1-α_i) fraction during the period (T_i-T_{1i}) is $(1-\alpha_i)\, d\, c\, e^{Rt_1} (T_i - T_{1i}) T_{00}\, Ie_i$

(c) If part payment is not done at T_{1i} then interest will be earned over α_i fraction for period (T_i-T_{1i}) but interest will also be charged for α_i fraction for (T_i-T_{1i}) period.

Interest earned= $d\, c\, e^{Rt_1}\ \alpha_i (T_i - T_{1i}) T_{00}\ Ie_i$

Interest charged= $d\, c\, e^{Rt_1}\ \alpha_i (T_i - T_{1i}) T_{00}\ Ic_i$

To discourage not doing promised payment, we assume that Ic_i is quite larger than Ie_i .

(d) Interest earned over the amount $dce^{Rt_1} T_{00} T_{1i} Ie_i$ over the period (T_i-T_{1i}) is $d\, c\, e^{Rt_1}\ T_{00}\, T_{1i}\, Ie_i\, (T_i - T_{1i})\, Ie_i$

(e) If the remaining amount is not cleared at T_i then interest will be earned for the period $(T_{00}-T_i)$ for $(1-\alpha_i)$ fraction simultaneously interest will be charged on the same amount for the same period.

Interest earned= $(1-\alpha_i)\, d\, c\, e^{Rt_1}(T_{00}-T_i)T_{00}\, Ie_i$

Interest charged= $(1-\alpha_i)\, d\, c\, e^{Rt_1}(T_{00}-T_i)T_{00}\, Ic_i$

Total interest earned and charged is as follows.

$$\begin{aligned}
& dce^{Rt_1}T_{00}T_{1i}Ie_i+(1-\alpha_i)dce^{Rt_1}(T_i-T_{1i})T_{00}\,Ie_i+\{dce^{Rt_1}\alpha_i(T_i-T_{1i})T_{00}\,Ie_i \\
& -dce^{Rt_1}\alpha_i(T_i-T_{1i})T_{00}\,Ic_i\}+dce^{Rt_1}T_{00}T_{1i}\,Ie_i(T_i-T_{1i})Ie_i \\
& +V_i[(1-\alpha_i)dce^{Rt_1}(T_{00}-T_i)T_{00}\,Ie_i+\ dce^{Rt_1}T_{00}T_{1i}\,Ie_i(T_i-T_{1i})Ie_i(T_{00}-T_i)Ie_i \\
& +dce^{Rt_1}T_{00}T_{1i}\,Ie_i(T_{00}-T_i)Ie_i+(1-\alpha_i)dce^{Rt_1}T_{00}(T_i-T_{1i})Ie_i(T_{00}-T_i)Ie_i \\
& +\{dce^{Rt_1}\alpha_i T_{00}\,Ie_i(T_i-T_{1i})Ie_i-dce^{Rt_1}\alpha_i(T_{00}-T_i)T_{00}\,Ic_i\} \\
& -(1-\alpha_i)dce^{Rt_1}(T_{00}-T_i)T_{00}\,Ic_i]
\end{aligned}$$

$A(q_i,r,\theta)$= (cost of ordering) + (cost of holding inventory) + (cost of item that deteriorate during a single interval that starts with an inventory of (q_i+r) units and ends with r units with inflation rate);

$$A(q_i,r,\theta)=k+\frac{1}{2}\frac{hq_i^{\,2}\,e^{Rt_1}}{(d+\theta)}+\frac{hrq_i\,e^{Rt_1}}{(d+\theta)}+\frac{\theta cq_i\,e^{Rt_1}}{(d+\theta)} \qquad i=0,1,2$$

7.3. OPTIMAL POLICY DECISION FOR THE MODEL:

Analysis of the average cost function requires the exact determination of the transition probabilities $P_{ij}(t)$, i, j=0, 1, 2, 3 for the four state CTMC. The lemma which is used to obtain the transition probabilities is same as discussed in chapter 4, (lemma (4.3.1)) hence we omit it here also lemma 4.3.4, 4.3.5, 5.3.2 and5.3.3 are also same hence we omit it here.

Proposition 7.3.1: The Average cost objective function for two suppliers under inflation and permissible delay in payments allowing partial payment is given by AC=$\frac{C_{00}}{T_{00}}$

C_{00} is given by

$$
\begin{aligned}
C_{00} = {} & A(q_0,r) + P_{01}\{C_{10} - dce^{Rt_1}T_{00}T_{11}Ie_1 - (1-\alpha_1)dce^{Rt_1}T_{00}(T_1 - T_{11})Ie_1 - U_1dce^{Rt_1}\alpha_1T_{00}(T_1 - T_{11})Ie_1 \\
& \quad + U_1dce^{Rt_1}\alpha_1T_{00}(T_1 - T_{11})Ic_1 - dce^{Rt_1}T_{00}T_{11}Ie_1(T_1 - T_{11})Ie_1 - V_1[(1-\alpha_1)dce^{Rt_1}T_{00}(T_{00} - T_1)Ie_1 \\
& + dce^{Rt_1}T_{00}T_{11}Ie_1(T_1 - T_{11})Ie_1(T_{00} - T_1)Ie_1 + dce^{Rt_1}T_{00}T_{11}Ie_1(T_{00} - T_1)Ie_1 \\
& + (1-\alpha_1)dce^{Rt_1}T_{00}(T_1 - T_{11})Ie_1(T_{00} - T_1)Ie_1] - V_1[U_1\{dce^{Rt_1}\alpha_1T_{00}Ie_1(T_1 - T_{11})(T_{00} - T_1)Ie_1\}] \\
& + V_1[U_1\{dce^{Rt_1}\alpha_1T_{00}Ic_1(T_{00} - T_1) + (1-\alpha_1)dce^{Rt_1}T_{00}Ic_1(T_{00} - T_1)\}]\ \} \\
& + P_{02}\{C_{20} - dce^{Rt_1}T_{00}T_{12}Ie_2 - (1-\alpha_2)dce^{Rt_1}T_{00}(T_2 - T_{12})Ie_1 - U_2dce^{Rt_1}\alpha_2T_{00}(T_2 - T_{12})Ie_2 \\
& \quad + U_2dce^{Rt_1}\alpha_2T_{00}(T_2 - T_{12})Ic_2 - dce^{Rt_1}T_{00}T_{12}Ie_2(T_2 - T_{12})Ie_2 - V_2[(1-\alpha_2)dce^{Rt_1}T_{00}(T_{00} - T_2)Ie_2 \\
& + dce^{Rt_1}T_{00}T_{12}Ie_2(T_2 - T_{12})Ie_2(T_{00} - T_2)Ie_2 + dce^{Rt_1}T_{00}T_{12}Ie_2(T_{00} - T_2)Ie_2 \\
& + (1-\alpha_2)dce^{Rt_1}T_{00}(T_2 - T_{12})Ie_2(T_{00} - T_2)Ie_2] - V_2[U_2\{dce^{Rt_1}\alpha_2T_{00}Ie_2(T_2 - T_{12})(T_{00} - T_2)Ie_2\}] \\
& + V_2[U_2\{dce^{Rt_1}\alpha_2T_{00}Ic_2(T_{00} - T_2) + (1-\alpha_2)dce^{Rt_1}T_{00}Ic_2(T_{00} - T_2)\}]\ \} \\
& + P_{03}\{\overline{C} + \rho_1 \left[\begin{array}{l}
C_{10} - dce^{Rt_1}T_{00}T_{11}Ie_1 - (1-\alpha_1)dce^{Rt_1}T_{00}(T_1 - T_{11})Ie_1 - U_1dce^{Rt_1}\alpha_1T_{00}(T_1 - T_{11})Ie_1 \\
+ U_1dce^{Rt_1}\alpha_1T_{00}(T_1 - T_{11})Ic_1 - dce^{Rt_1}T_{00}T_{11}Ie_1(T_1 - T_{11})Ie_1 \\
- V_1[(1-\alpha_1)dce^{Rt_1}T_{00}(T_{00} - T_1)Ie_1 + dce^{Rt_1}T_{00}T_{11}Ie_1(T_1 - T_{11})Ie_1(T_{00} - T_1)Ie_1 \\
+ dce^{Rt_1}T_{00}T_{11}Ie_1(T_{00} - T_1)Ie_1 + (1-\alpha_1)dce^{Rt_1}T_{00}(T_1 - T_{11})Ie_1(T_{00} - T_1)Ie_1] \\
- V_1[U_1\{dce^{Rt_1}\alpha_1T_{00}Ie_1(T_1 - T_{11})(T_{00} - T_1)Ie_1\}] \\
+ V_1[U_1\{dce^{Rt_1}\alpha_1T_{00}Ic_1(T_{00} - T_1) + (1-\alpha_1)dce^{Rt_1}T_{00}Ic_1(T_{00} - T_1)\}]\ \}
\end{array}\right] \\
& \rho_2 \left[\begin{array}{l}
C_{20} - dce^{Rt_1}T_{00}T_{12}Ie_2 - (1-\alpha_2)dce^{Rt_1}T_{00}(T_2 - T_{12})Ie_1 - U_2dce^{Rt_1}\alpha_2T_{00}(T_2 - T_{12})Ie_2 \\
+ U_2dce^{Rt_1}\alpha_2T_{00}(T_2 - T_{12})Ic_2 - dce^{Rt_1}T_{00}T_{12}Ie_2(T_2 - T_{12})Ie_2 \\
- V_2[(1-\alpha_2)dce^{Rt_1}T_{00}(T_{00} - T_2)Ie_2 + dce^{Rt_1}T_{00}T_{12}Ie_2(T_2 - T_{12})Ie_2(T_{00} - T_2)Ie_2 \\
+ dce^{Rt_1}T_{00}T_{12}Ie_2(T_{00} - T_2)Ie_2 + (1-\alpha_2)dce^{Rt_1}T_{00}(T_2 - T_{12})Ie_2(T_{00} - T_2)Ie_2] \\
- V_2[U_2\{dce^{Rt_1}\alpha_2T_{00}Ie_2(T_2 - T_{12})(T_{00} - T_2)Ie_2\}] \\
+ V_2[U_2\{dce^{Rt_1}\alpha_2T_{00}Ic_2(T_{00} - T_2) + (1-\alpha_2)dce^{Rt_1}T_{00}Ic_2(T_{00} - T_2)\}]\ \}
\end{array}\right] \}
\end{aligned}
$$

and $\quad T_{00} = \dfrac{q_0}{d+\theta} + P_{01}T_{10} + P_{02}T_{20} + P_{03}(\overline{T} + \rho_1T_{10} + \rho_2T_{20})$

Proof: Proof follows using Renewal reward theorem (RRT). The optimal solution for q_0, q_1, q_2 and r is obtained by using Newton Rapson method in R programming.

7.4. NUMERICAL EXAMPLE:

There are sixteen different patterns of payments, some of them we consider here.

1. Ui=0 and Vi=0 where i=1, 2 that is promise of doing part payment at time T_{1i} and clearing the remaining amount at time T_i, the time period given by i^{th} supplier where i=1, 2, both are satisfied.

2. Ui=0 and Vi=1 where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied but remaining amount is not cleared at time T_i , the time period given by i^{th} supplier where i=1, 2.

3. Ui=1 and Vi=0 where i=1, 2 that is promise of doing part payment at time T_{1i} is not satisfied for both the suppliers but all the amount are cleared at time T_i , the time period given by i^{th} supplier where i=1, 2.

4. Ui=0, V_1=0 and V_2=1 where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied for both suppliers and clearing the remaining amount at time T_1 for 1^{st} supplier is satisfied, but remaining amount is not cleared at time T_2 for 2^{nd} supplier.

5. Ui=0, V_1=1 and V_2=0 where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied for both suppliers and promise of clearing the remaining amount at time T_2 for 2^{nd} supplier is satisfied, but remaining amount is not cleared at time T_1 for 1^{st} supplier.

6. U_1=0, U_2=1 and V_i=0 where i=1, 2 that is promise of doing part payment at time T_{11} is kept for 1^{st} supplier but promise of doing part payment at time T_{12} is not satisfied for 2^{nd} supplier however clearing the remaining amount at time T_i, the time period given by i^{th} supplier where i=1, 2, are satisfied for both the suppliers.

7. U_1=1, U_2=0 and V_i=0 where i=1, 2 that is promise of doing part payment at time T_{11} is not satisfied for 1^{st} supplier but promise of doing part payment at time T_{12} is satisfied for 2^{nd} supplier however clearing the remaining amount at time T_i, the time period given by i^{th} supplier where i=1, 2 are satisfied for both the suppliers.

In this section we verify the results by a numerical example. We assume that k=Rs. 5/order, c=Rs.1/unit, d=20/units, θ=4, h=Rs. 5/unit/time, π=Rs. 350/unit, T_{11}=0.6, $\hat{\pi}$=Rs. 25/unit/time, α_1=0.5, α_2=0.6, Ic_1=0.11, Ie_1=0.02, Ic_2=0.13, Ie_2=0.04, T_{12}=0.8, T_1=0.9, T_2=1.1, R=0.05, t_1=6 λ_1=0.58, λ_2=0.45, μ_1=3.4, μ_2=2.5.

The last four parameters indicate that the expected lengths of the ON and OFF periods for first and second supplier are $1/\lambda_1$=1.72413794, $1/\lambda_2$=2.2222, $1/\mu_1$=.2941176 and $1/\mu_2$=.4 respectively. The long run probabilities are obtained as p_0=0.7239588, p_1=0.1303126, p_2 =0.1234989 and p_3=0.02222979. The optimal solution for the above numerical example based on the seven patterns of payment is obtained as

(U_1,U_2,V_1,V_2)	q_0	q_1	q_2	r	AC
(0,0,0,0)	2.8044	28.8243	28.035	0.71827	8.18389
(0,0,1,1)	2.55527	28.5755	27.715	0.64861	8.28186
(1,1,0,0)	2.8538	28.799	28.0153	0.73958	8.14469
(0,0,0,1)	2.6286	28.6399	27.8001	0.67088	8.2503
(0,0,1,0)	2.7077	28.7305	27.9146	0.69175	8.2195
(0,1,0,0)	2.8326	28.8095	28.0235	0.73052	8.1607
(1,0,0,0)	2.8251	28.813	28.026	0.7272	8.168011

Conclusion:

From this we conclude that the cost is minimum if part payment is not done at T_{1i} but account is cleared at T_i and the cost is maximum if part payment is done at T_{1i} but account is not cleared at T_i, this implies that we encourage the small businessmen to do the business by allowing partial payment and simultaneously we want to discourage them for not clearing the account at the end of credit period.

7.5. SENSITIVITY ANALYSIS:

To observe the effects of varying parameter values on the optimal solution we have conducted sensitivity analysis, by varying value of inflation rate R on the following seven patterns of payment.

(i) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where $U_i=0$ and $V_i=0$ where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied but remaining amount is not cleared at time T_i, the time period given by i^{th} supplier where i=1, 2. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.1.

Table 7.5.1
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is ($U_1=0$, $U_2=0$, $V_1=0$, $V_2=0$)

R	q_0	q_1	q_2	r	AC
0.05	2.8044	28.8243	28.035	0.71827	8.18389
0.1	2.38808	27.72073	26.7435	0.67913	10.50586
0.15	2.0325	26.8227	25.6677	0.63246	13.5493
0.2	1.72991	26.0919	24.7733	0.58148	17.5515
0.25	1.472827	25.49633	24.03038	0.528973	22.83057

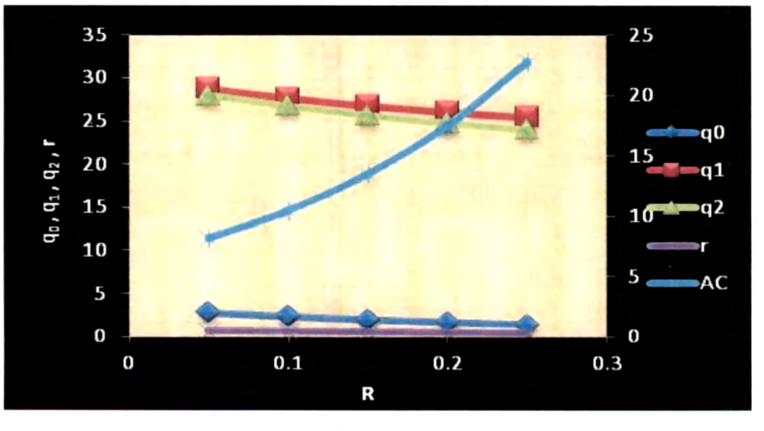

Fig. 7.5.1 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

We see that as inflation rate R increases, results in increase in average cost, when businessmen settle all the account for both the suppliers at the respective time.

(ii) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where $U_i=0$ and $V_i=1$ where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied but remaining amount is not cleared at time T_i, the time period given by i[th] supplier where i=1, 2. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.2.

Table 7.5.2
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is (U_1=0, U_2=0, V_1=1, V_2=1)

R	q_0	q_1	q_2	r	AC
0.05	2.55527	28.5755	27.715	0.64861	8.28186
0.1	2.20818	27.5466	26.5099	0.6217	10.5985
0.15	1.904439	26.70043	25.4976	0.58679	13.63506
0.2	1.63989	26.00519	24.649	0.5464	17.6286
0.25	1.41041	25.43376	23.93952	0.50306	22.89708

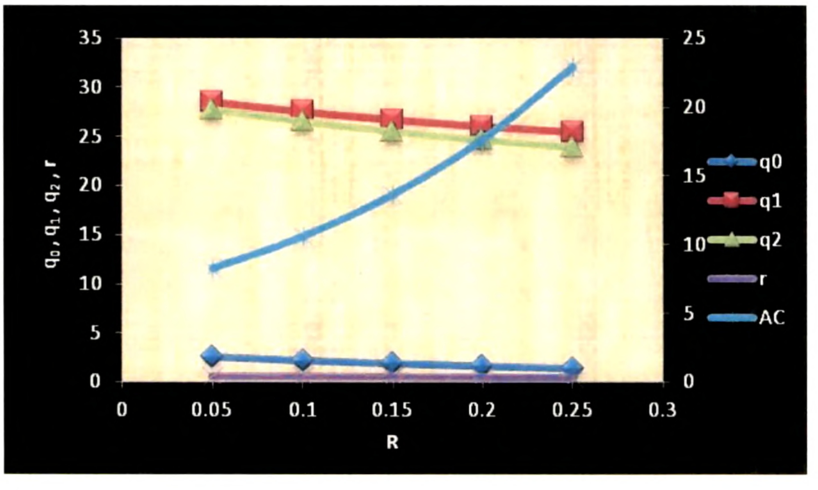

Fig. 7.5.2 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

Increasing the value of inflation rate R, results in increase in average cost, when part payment is done for both the suppliers at the given time, but remaining amount is not cleared at the respective time given by both the suppliers.

(iii) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where U_i=1 and V_i=0 where i=1, 2 that promise of doing part payment at time T_{1i} is not satisfied but all the amount is cleared at time T_i, the time period given by i^{th} supplier where i=1, 2. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.3.

Table 7.5.3
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is (U_1=1, U_2=1, V_1=0, V_2=0)

R	q_0	q_1	q_2	r	AC
0.05	2.8538	28.799	28.0153	0.73958	8.14469
0.1	2.43058	27.6947	26.7234	0.70022	10.45932
0.15	2.0687	26.79694	25.6477	0.6527	13.49431
0.2	1.76056	26.0669	24.75399	0.60075	17.48683
0.25	1.498653	25.47265	24.01201	0.546858	22.75464

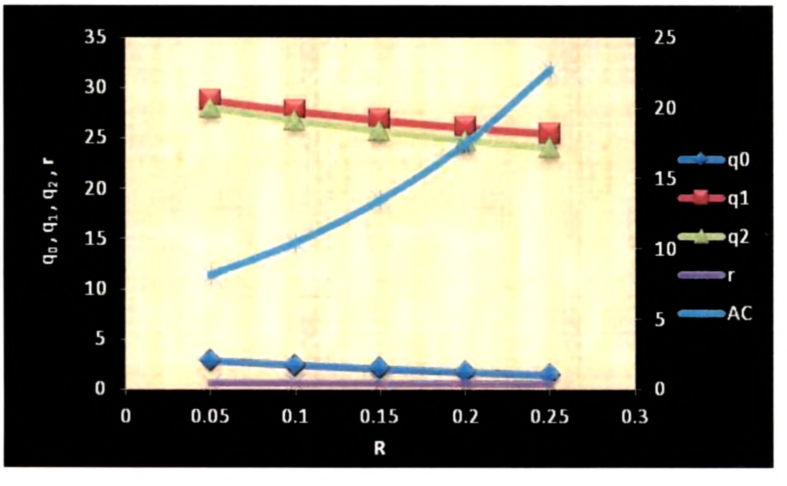

Fig. 7.5.3 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

We see that as inflation rate R increases, average cost increases, when part payment is not done for both the suppliers at the given time, but remaining amount is cleared at the respective time given by both the suppliers.

(iv) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where Ui=0, V_1=0 and V_2=1 where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied for both suppliers and clearing the remaining amount at time T_1 for 1st supplier is satisfied, but remaining amount is not cleared at time T_2 for 2nd supplier. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.4.

Table 7.5.4
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is (U_1=0, U_2=0, V_1=0, V_2=1)

R	q_0	q_1	q_2	r	AC
0.05	2.6286	28.6399	27.8001	0.67088	8.2503
0.1	2.261854	27.59264	26.57341	0.640006	10.56836
0.15	1.943228	26.73339	25.54476	0.601397	13.60659
0.2	1.667597	26.02892	24.68429	0.557797	17.60238
0.25	1.429954	25.45107	23.96543	0.51159	22.87361

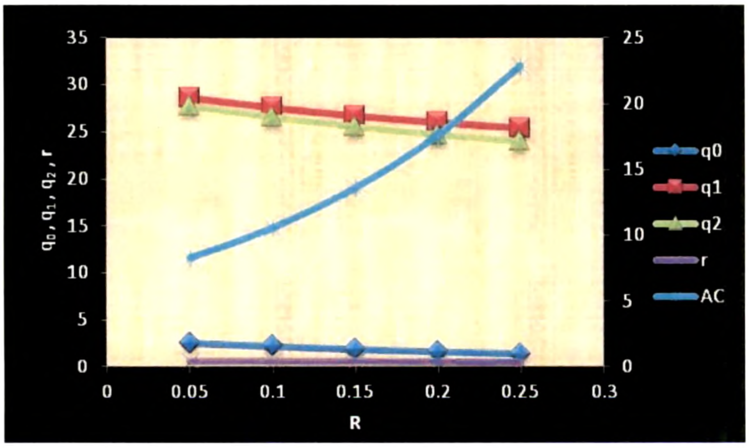

Fig. 7.5.4 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

We see that as inflation rate R increases, average cost increases, when part payment is done for both the suppliers at the given time and the remaining amount is cleared at time T_1 for 1st supplier, however remaining amount is not cleared at time T_2 for 2nd supplier.

(v) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where Ui=0, V_1=1 and V_2=0 where i=1, 2 that is promise of doing part payment at time T_{1i} is satisfied for both suppliers and promise of clearing the remaining amount at time T_2 for 2nd supplier is satisfied, but remaining amount is not cleared at time T_1 for 1st supplier. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.5.

Table 7.5.5
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is (U_1=0, U_2=0, V_1=1, V_2=0)

R	q_0	q_1	q_2	r	AC
0.05	2.7077	28.7305	27.9146	0.69175	8.2195
0.1	2.319587	27.65739	26.65832	0.657395	10.53958
0.15	1.984613	26.77981	25.60752	0.615251	13.58067
0.2	1.696712	26.06255	24.73068	0.568359	17.58012
0.25	1.450045	25.4759	24.00002	0.519217	22.85588

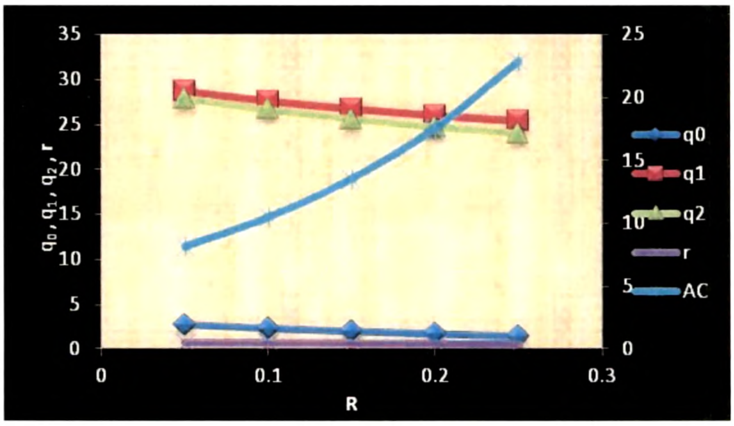

Fig. 7.5.5 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

Increasing the inflation rate R, results in increase in average cost, when part payment is done for both the suppliers at the given time and the remaining amount is cleared at time T_2 for 2nd supplier, however remaining amount is not cleared at time T_1 for 1st supplier.

(vi) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where $U_1=0$, $U_2=1$ and $V_i=0$ where i=1, 2 that is promise of doing part payment at time T_{11} is satisfied for 1st supplier but promise of doing part payment at time T_{12} is not cleared for 2nd supplier however clearing the remaining amount at time T_i, the time period given by ith supplier where i=1, 2, are satisfied for both the suppliers. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.6.

Table 7.5.6
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is ($U_1=0$, $U_2=1$, $V_1=0$, $V_2=0$)

R	q_0	q_1	q_2	r	AC
0.05	2.8326	28.8095	28.0235	0.73052	8.1607
0.1	2.412552	27.70555	26.73171	0.691337	10.47825
0.15	2.053535	26.80758	25.6559	0.644287	13.51658
0.2	1.74778	26.07718	24.76184	0.592769	17.51294
0.25	1.48795	25.48231	24.01946	0.539494	22.78518

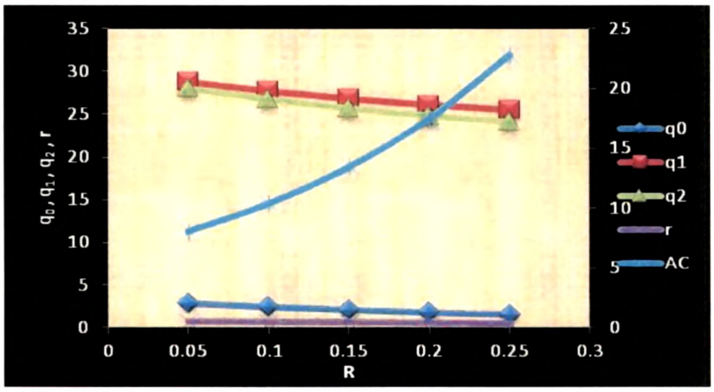

Fig. 7.5.6 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

We see that as inflation rate R increases, average cost increases, when part payment at time T_{11} is done for 1st supplier but part payment at time T_{12} is not cleared for 2nd supplier however remaining amount is cleared at the respective time given by both the suppliers.

(vii) To observe the effect of varying parameter values on the optimal solution, we have conducted sensitivity analysis by varying the value of inflation rate R and keeping other parameter values fixed where $U_1=1$, $U_2=0$ and $V_i=0$ where i=1, 2 that is promise of doing part payment at time T_{11} is not satisfied for 1st supplier but promise of doing part payment at time T_{12} is satisfied for 2nd supplier however clearing the remaining amount at time T_i, the time period given by ith supplier where i=1, 2 are satisfied for both the suppliers. Inflation rate R is assumed to take values 0.05, 0.1, 0.15, 0.2 and 0.25. We resolve the problem to find optimal values of q_0, q_1, q_2, r and AC. The optimal values of q_0, q_1, q_2, r, AC and R are plotted in Fig. 7.5.7.

Table 7.5.7
Sensitivity Analysis Table by varying the parameter values of R when patterns of payment is (U_1=1, U_2=0, V_1=0, V_2=0)

R	q_0	q_1	q_2	r	AC
0.05	2.8251	28.813	28.026	0.7272	8.168011
0.1	2.405692	27.70974	26.73496	0.687934	10.4871
0.15	2.047394	26.81195	25.65929	0.640833	13.52723
0.2	1.74237	26.08159	24.76526	0.589369	17.52567
0.25	1.48324	25.48662	24.02281	0.536231	22.80031

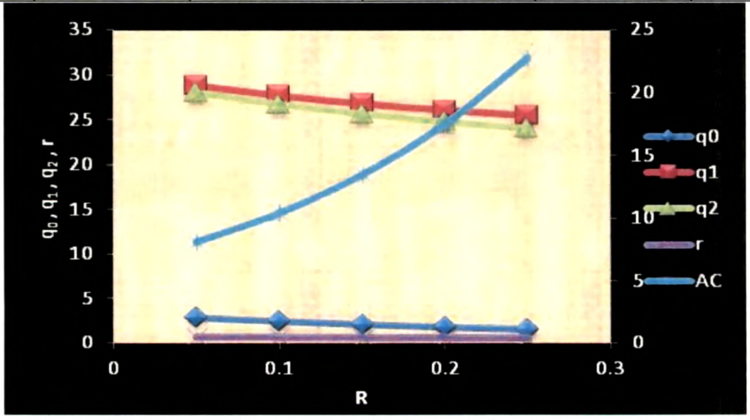

Fig. 7.5.7 Sensitivity Analysis Graph for Average cost with respect to varying inflation rate R

We see that as inflation rate R increases, average cost increases, when part payment at time T_{11} is not done for 1st supplier but part payment at time T_{12} is cleared for 2nd supplier and remaining amount is cleared at the respective time given by both the suppliers.

7.6. CONCLUSION:

From this we conclude that the cost is minimum if part payment is not done at T_{1i} but account is cleared at T_i and the cost is maximum if part payment is done at T_{1i} but the account is not cleared at T_i, this implies that we encourage the small businessmen to do the business by allowing partial payment and simultaneously we want to discourage them for not clearing the account at the end of credit period. The option of part payment is very useful for enhancing business and encouraging the small entrepreneurs. Comparing the average cost with that of chapter 3 in all the situations, we find that cost is less here as there are two suppliers, so here also we can conclude that two suppliers help in reducing the average cost.