CHAPTER 6
RESULTS & DISCUSSIONS

6.1 Two stage supply chain

Three forecasting methods are considered in the above analysis to select appropriate values of give parameters to minimum bullwhip effect. First set lead time of retailer_1 and retailer_2 (= 3) and \( \phi_1 = \phi_2 = 0.6 \), study is conducted to choose appropriate \( k \), \( \beta_1 \), and \( \beta_2 \). The MMSE method minimizes the variance of the forecasting error among all the linear forecasting methods. It obviously lead to the lowest average cost among the three forecasting approaches. When MA forecast data at \( k=3 \) and exponential smoothing forecast data \( \beta =0.5 \) i.e. at \( k=3 \), BWE values are very close. From Fig 4.15-4.17, the trends of the three bullwhip effects are the same. However the values of them change obviously. According to fig 4.15, when \( k = 3 \), correspondingly \( \beta_1 = \beta_2 = 0.5 \), measured BWE in MMSE is found least. BWE in MMSE and BWE in ES decrease firstly to the minimum value and then increase with the increase of \( \alpha \). However, BWE in MA has opposite trend. When \( \beta_1 \) is smaller than a certain value, BWE in MA is lower than BWE in ES; when \( \beta_1 \) is larger than the certain value and smaller than another certain value, BWE in MA is higher than BWE in ES; and when \( \alpha \) is larger than another certain value, BWE in MA is lower than BWE in ES again. It means that the MMSE forecasting method is the best to forecast lead-time demand in this situation.

Fig 4.16 reveals that the bullwhip effect under three forecasting methods of \( k = 9 \) and \( \beta_1 = \beta_2 = 0.2 \) have the same trends with the circumstance of \( k=3 \) and \( \beta_1 = \beta_2 = 0.5 \). But BWE in MMSE is no longer the lowest of all, and it becomes the highest of the three. BWE in MA and BWE in ES are the same as fig 5.4.1. It means that when \( \alpha \) is larger than a certain value and smaller than another certain value, the ES forecasting method is the best. In the other situation, the MA is the most attractive one. To conclude better adopt ES forecasting method when the intense competition between two retailers exists.

In fig 4.17 set value of \( k=19 \) and \( \beta_1 = \beta_2 = 0.1 \), and in this circumstance, BWE in MMSE is the highest all the time regardless of different \( \alpha \). BWE in ES is a fixed value with the increase of \( \alpha \). BWE in MA is the lowest of all. This phenomenon reveals that the MA method is the best forecasting method whatever \( \alpha \) is as long as \( k = 19 \) or \( k \) is larger.
6.2 Effect of the autoregressive coefficient of the demand process on the inventory costs:

The impact of the autoregressive coefficient of the demand process on the total inventory costs of the retailers and the warehouse as well as the inventory cost saving, another series of numerical experiments was conducted with the same parameter values as those used above. However, in these experiments, to set $z=1.28$ and $\mu_w=150$ and vary the values of the autoregressive coefficient from -0.8 to 0.8. Results are shown in Table 5.5.

6.3 Effect of the lead time on the inventory costs:

A series of numerical experiments was performed to examine the effect of lead time on the inventory costs. All parameters were set as before, but we set $z=1.28$ and $\mu_w=150$ and vary the length of lead time from 2 to 4 in these experiments. Results are displayed in Table 10. For given values of $m_w$ and $\mu_w$, the inventory cost saving decreases as lead-time increases, because of the dominating effect of the shortage cost. Moreover, when lead-time is long, the use of the warehouse in the supply chain may not be beneficial for the system. For example, when $l=4$, the inventory cost savings are negative in almost all cases.