CHAPTER 6

Order policies appropriate to retail banking

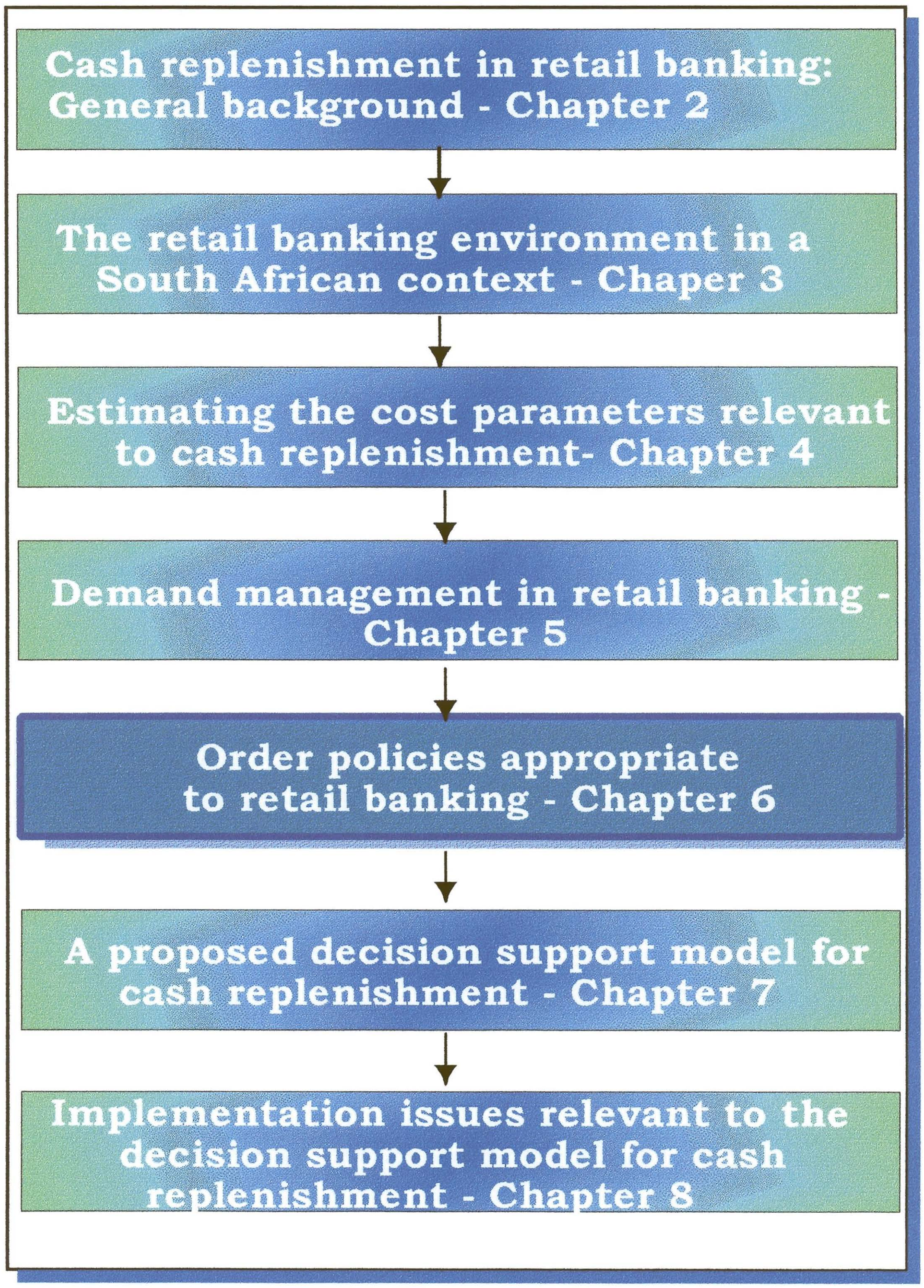
6.1 Introduction

In this chapter, proof will be provided that alternative order policies to the policy currently in use at the branch may be employed without compromising customer service (embodied by a shortage at the cash point) and at the same time, reducing the cost of holding cash inventories. The current policy is investigated as well as the adherence to this policy. The daily cost of holding inventory under the current policy is estimated and compared to the cost of other policies challenging some of the constraints embedded in the current policy. Furthermore, the effect of changes to some of the cost parameters is also investigated. Finally, in Chapter 7, the information provided by this and the previous chapter will be used to propose a decision support model - the details of which will be discussed in the next chapter.

Figure 6.1 shows the relevance of appropriate order policies to the other chapters included in the thesis.

Figure 6.1

The structure of the report indicating the relevance of Chapter 6



6.2 Fitting distributions to the demand and withdrawal patterns

In developing alternative order policies for the branch, simulation runs were performed to evaluate the cost of the proposed policies. Before this could be done, a series of random numbers representing the total demand and total withdrawal patterns at the branch were generated based on appropriate probability distributions.

Using the *Input Analyzer* function of *Arena®* (Kelton *et al.* 1998), various distributions were fitted to the available data describing demand and withdrawal patterns. *Input Analyzer* fits a number of different probability distributions, providing an indication of the goodness of fit. Since the Weibull distribution provided an acceptable fit to both the deposits (squared error = 0.022) and withdrawals (squared error = 0.0125), it was selected to represent the distributions for both deposits and withdrawals. Kelton *et al.* (1998:514) state that the Weibull distribution is particularly useful to represent non-negative values that are skewed to the left. (Refer to appendices A4, B4 and C4 for confirmation of the shape of the deposit, total withdrawal and ATM withdrawal histograms respectively.)

As a first step to simulating conditions at the branch, 960 data points describing deposits and total withdrawals per day were generated from the fitted probability distributions. The differences between the daily deposits and total withdrawals generated, were calculated. The normal distribution was fitted to these differences, providing a square error of 0.0033 - indicating that the differences were normally distributed as would be expected. This data string was used as an initial test to investigate the sensitivity of the total cost of holding cash inventory to changes in certain parameters, for example safety stock, reorder point, order quantity and also the impact of an estimate of the shortage cost.

The second step in the investigation was to test the best alternatives from each simulation run against the actual total withdrawal and deposit patterns obtained from the branch, and to compare the cost of the proposed policies to the actual cost of the existing policy.

6.3 Existing order policy

6.3.1 Formulation

The branch does not have an explicit policy on cash replenishment although various unwritten rules do exist within a broad framework. As pointed out in Chapter 4, the guidelines followed at the branch *inter alia* include:

- As far as possible a single order is placed per week;
- an order is placed if the main safe balance is below R500 000, implying the use of a safety stock level of R500 000;
- special deliveries (minimum order quantity of R500 000), with a lead time of one day, are only possible if authorised by the regional office, and are to be avoided;
- a lead time of two days is used, unless the order is placed for a Friday, when a lead time of three days is used; and
- only in exceptional cases, for example where notes are unfit for use by the cashiers, is cash returned to SBV.

From the above, the branch-specific nature of some of these rules is obvious in contrast to some rules that are generic in character.

6.3.2 Application

Appendix I provides a comparison of the application of the order policy detailed in Figure 4.2 as well as in the previous paragraph, to the actual activities which occurred at the branch during the period under review. From the appendix, it is quite clear that many of the rules incorporated in the policy are not strictly adhered to. The only rule which seems to be followed fairly consistently, is the avoidance of special orders. This is obvious from Appendix F, since only one special order was placed at the end of April. This occurrence was the direct result of the move of the branch to its new location.

6.3.3 Cost of existing policy

Appendices A to D show the calculations required to determine the actual amount of cash on hand in the branch at the end of each trading day during the three month period under review. Once these actual on hand amounts had been calculated, it was possible to determine the cost of holding the cash. The cost calculations were based on the cost parameters determined in Chapter 4. In Appendix E the daily cash storage cost is determined, while the daily cash supply cost is calculated in Appendix F. The total daily cost of holding cash is finally summarised in Appendix G.

The total cost over the three month period is as follows:

April	R 79 915
May	R 82 952
June	R 85 463
TOTAL	**R 248 330**

On a daily basis this is equal to R 2 728.90.

The next paragraph is dedicated to finding alternative policies which will reduce the daily cost.

6.4 Alternative order policies

6.4.1 Method of investigation

The method used to investigate alternative order policies which could produce a reduction in the total cost of holding cash inventories, to a certain extent represented a random process of sub optimisation. As a first step, random numbers were generated to represent the total withdrawal and deposit patterns as described earlier in paragraph 6.2. The next step was to decide on the scope of the shortage cost involved, since the bank refrained from placing a value on that component of the total cost of holding cash. An assumption was made that a relationship exists between storage cost and shortage cost, since in this particular case, if the branch cannot provide the required cash amount, the situation may be seen as one where the branch is borrowing that amount from the customer. It was decided to use various values for shortage cost, for example shortage cost equal to twice the storage cost, then ten times the storage cost and finally 50 times the storage cost.

The branch essentially sets safety stock and the reorder point at the same level, *i.e.* R500 000. For purposes of the simulation runs, the safety stock was not assumed to be equal to the reorder point. Therefore the reorder point would trigger a normal order having a lead time of two days, whereas the safety stock level would trigger a special order having a lead time of one day. The safety stock was set at three different levels, initially R200 000, then R500 000, and finally R1 000 000. In paragraph 6.4.2.2 further levels of safety stock were investigated. At the same time, the special order size was set at R500 000. In paragraph 6.4.2.3 other special order sizes were investigated. The branch policy precludes returning excess amounts of cash to SBV - only coin and notes unfit for circulation may be returned. In paragraph 6.4.2.4 the option of returning excess cash is investigated.

Finally, the branch operations manager mentioned that delivery of normal orders often occurred only after 13:00 on the designated day, rendering the true lead time two and a half days. A special order was almost always delivered after trading had ended, *i.e.* after 15:30, which implies a lead time of two days rather than one day. One way of overcoming this uncertainty is to assume the respective lead times being three and two days, rather than two and one day. The effect of this assumption is investigated in paragraph 6.4.2.5, since it could have a bearing on the safety stock level.

As was explained earlier, the initial runs were carried out on 960 simulated data points generated from the fitted distributions. These distributions did not allow for the seasonality present in the deposit and withdrawal patterns described in the previous chapter. Therefore when investigating a specific policy, it was deemed viable only if it lead to a situation where shortages occurred on fewer than 48 out of 960 days, *i.e.* 5% of the days. Subsequently, when testing a policy against the actual figures, no shortages were allowed. Therefore situations arose where the best policy based on the initial run lead to a shortage in the second stage. The policy would then be adjusted until the next best option was found avoiding shortages. The investigation did not limit the number of order placed per week and no explicit avoidance of special orders was built into the simulation.

6.4.2 Results

6.4.2.1 Effect of shortage cost

As explained earlier, the bank does not quantify shortage cost - a shortage is something to be avoided at all cost. In an attempt to gauge the impact that a shortage would have on the total cost, a value had to be placed on a shortage should it occur. Three different values were investigated based on the assumption that a relationship exists between shortage cost and inventory holding cost. Initially, shortage cost was assumed to be twice the inventory holding cost, then ten times the inventory holding cost and finally 50 times the inventory holding cost. A summary of the results of this investigation is shown in Table 6.1. In each of the three cases investigated an initial inventory of R1 000 000 was assumed, safety stock was set at three different levels (*i.e.* R200 000, R500 000 and R1 000 000), the order size was first set at R500 000, then at R750 000 and finally at R1 000 000, and the reorder point was increased in increments of R100 000, from R300 000 to R2 500 000. The full results of this investigation are reported in Appendix J. The abbreviations used in Tables 6.1 to 6.9 are SS for safety stock, SQ for special order size, Q for the reorder quantity, ROP for the reorder point and UL for upper limit for the amount of cash held at the branch.

Table 6.1

Summary of the investigation into the scope of shortage cost

(Based on Appendix J)

Safety stock	Order quantity	Optimum reorder point	Daily cost
Shortage cost = 2 x Inventory holding cost ($c_2 = 2c_1$)			
SS = 200 000	Q = 500 000	ROP = 1 100 000	R2 800
SQ = 500 000	Q = 750 000	ROP = 900 000	R2 782
(Appendix J-1)	Q = 1 000 000	ROP = 900 000	R2 814
SS = 500 000	Q = 500 000	ROP = 1 100 000	R2 852
SQ = 500 000	Q = 750 000	ROP = 700 000	R2 805
(Appendix J-2)	Q = 1 000 000	ROP = 600 000	R2 860
SS = 1 000 000	Q = 500 000	ROP = 600 000	R2 873
SQ = 500 000	Q = 750 000	ROP = 300 000	R2 861
(Appendix J-3)	Q = 1 000 000	ROP = 300 000	R2 888
Shortage cost = 10 x Inventory holding cost ($c_2 = 10c_1$)			
SS = 200 000	Q = 500 000	ROP = 1 100 000	R2 869
SQ = 500 000	Q = 750 000	ROP = 900 000	R2 831
(Appendix J-4)	Q = 1 000 000	ROP = 900 000	R2 872
SS = 500 000	Q = 500 000	ROP = 1 100 000	R2 894
SQ = 500 000	Q = 750 000	ROP = 800 000	R2 863
(Appendix J-5)	Q = 1 000 000	ROP = 900 000	R2 896
SS = 1 000 000	Q = 500 000	ROP = 600 000	R2 924
SQ = 500 000	Q = 750 000	ROP = 300 000	R2 911
(Appendix J-6)	Q = 1 000 000	ROP = 600 000	R2 939
Shortage cost = 50 x Inventory holding cost ($c_2 = 50c_1$)			
SS = 200 000	Q = 500 000	ROP = 1 500 000	R3 136
SQ = 500 000	Q = 750 000	ROP = 900 000	R3 078
(Appendix J-7)	Q = 1 000 000	ROP = 1 400 000	R3 107
SS = 500 000	Q = 500 000	ROP = 1 500 000	R3 093
SQ = 500 000	Q = 750 000	ROP = 1 400 000	R3 038
(Appendix J-8)	Q = 1 000 000	ROP = 1 000 000	R3 054
SS = 1 000 000	Q = 500 000	ROP = 1 000 000	R3 082
SQ = 500 000	Q = 750 000	ROP = 800 000	R3 068
(Appendix J-9)	Q = 1 000 000	ROP = 800 000	R3 064

From the table it is obvious that the policy which consistently provides the lowest cost option under the first two shortage cost assumptions, is a safety stock level of R200 000 and an order quantity of R900 000. However, when shortage cost is assumed to be 50 times the storage cost, the best option is a safety stock level of R500 000 and an order quantity of R1 400 000. These "best" options correspond to expectations in as much as a higher shortage cost would lead to a higher safety stock level and reorder point to avoid incurring the shortage cost.

If these policies are tested against the actual withdrawals and deposits over the three month period, the cost of holding cash may be significantly reduced compared to the cost of the current policy (discussed in paragraph 6.3.3). Table 6.2 shows the cost of these policies for the actual withdrawal and deposit amounts.

Table 6.2

Proposed policies applied to actual amounts

(Special order size SQ = R500 000)

Policy	Cost		Number of orders		Number of shortages
	Total	Daily	Normal	Special	
$c_2 = 2\ c_1$ Q = 750 000 SS = 200 000 ROP = 900 000	R 224 435	R2 466	16	2	0
$c_2 = 10\ c_1$ Q = 750 000 SS = 200 000 ROP = 900 000	R 224 435	R2 466	16	2	0
$c_2 = 50\ c_1$ Q = 750 000 SS = 500 000 ROP = 1 400 000	R 246 791	R2 712	18	0	0

Compared to the actual cost for the period under review, a substantial reduction would have been possible, had any one of the above policies been followed. A reduction of almost 10% could have been achieved by following a policy where the reorder quantity equals R750 000, safety stock is set at R200 000 and a reorder point of R900 000 is used. This was under the assumption that shortage cost is equal to twice (or ten times) the storage cost.

The impact of the safety stock level has been included to an extent in the analysis performed above, but deserves further probing.

6.4.2.2 Effect of safety stock

To investigate the impact of the safety stock level, the order quantity was fixed at R750 000, which seemed to provide good results based on the conclusions drawn in paragraph 6.4.2.1. The shortage cost was assumed to be equal to ten times the inventory holding cost (*i.e.* $c_2 = 10c_1$). Safety stock levels of zero, R200 000, R300 000, R500 000, R750 000 and R1 000 000 were investigated. The full results are shown in Appendix K, although some of the results presented in Appendices J-4-2, J-5-2 and J-6-2 are also relevant. A summary of the best results at each safety stock level is given in Table 6.3. All calculations were based on the 960 simulated data points.

Table 6.3

Summary of the investigation into the impact of safety stock levels

(Simulated figures with special order size SQ = R500 000 and $c_2 = 10c_1$)

Safety stock	Order quantity	Optimum reorder point	Daily cost
SS = 0 (Appendix K-1)	Q = 750 000	ROP = 1 000 000	R2 863
SS = 200 000 (Appendix J-4-2)	Q = 750 000	ROP = 900 000	R2 831
SS = 300 000 (Appendix K-2)	Q = 750 000	ROP = 900 000	R2 847
SS = 500 000 (Appendix J-5-2)	Q = 750 000	ROP = 800 000	R2 863
SS = 750 000 (Appendix K-3)	Q = 750 000	ROP = 600 000	R2 880
SS = 1 000 000 (Appendix J-6-2)	Q = 750 000	ROP = 300 000	R2 911

From Table 6.3 it may seem that the safety stock level does not have much impact on the daily cost. The "best" policy seems to be a safety stock level of R200 000 combined with a reorder point of R900 000. To confirm the findings, the safety stock levels are tested against the actual withdrawals and deposits. The results of this investigation are shown in Table 6.4.

Table 6.4

Proposed safety stock levels applied to actual amounts

(c_2 = 10 c_1, Q = 750 000 and special order size = R500 000)

Policy	Cost		Number of orders		Number of shortages
	Total	Daily	Normal	Special	
SS = 0 ROP = 1 000 000	R 231 822	R 2 547	18	0	0
SS = 200 000 ROP = 900 000	R 224 435	R 2 466	16	2	0
SS = 300 000 ROP = 900 000	R 224 435	R 2 466	16	2	0
SS = 500 000 ROP = 800 000	R 233 858	R 2 570	13	7	1[1]
SS = 500 000 ROP = 900 000	R 231 672	R 2 546	14	5	0
SS = 750 000 ROP = 600 000	R 235 578	R 2 589	9	13	0
SS = 1 000 000 ROP = 300 000	R 236 419	R 2 598	1	24	0

1. Since shortages are not acceptable, the next reorder point level for a safety stock level of R500 000 is found, which will prevent shortages of occurring. The reorder point level which does not lead to shortages, is R900 000.

As would be expected, the reorder point increases as the safety stock level decreases as seen in Table 6.4. Noticeable though, is the impact of no safety stock. Even if the safety stock level is set at 0, a reorder point of R1 000 000, will prevent shortages.

As before, all policies tested would have lead to a reduction in cost. The lowest daily cost is obtained where safety stock is equal to R200 000 or R300 000 and the reorder point is R900 000.

6.4.2.3 Special order size

Throughout the analyses performed to this point, the special order size has been set at a fixed amount of R500 000, which also is the minimum amount that may be ordered by special order. The next step in the analysis was to investigate other possible special order sizes, for example R750 000 and R1 000 000. Again, the relationship between shortage cost and inventory holding cost was assumed to be $c_2=10c_1$. The safety stock levels were set at R200 000, R500 000 and R1 000 000 respectively. The full results are shown in Appendix L, although the results shown in Appendices J-4-2, J-5-2 and J-6-2 also apply. The results are summarised in Table 6.5.

From Table 6.5, the special order size does not seem to have a significant impact on the daily cost based on the simulated figures. However, a safety stock level of R200 000 consistently provides the lowest cost alternative irrespective of the special order size. As before, the policies investigated are tested against the actual figures supplied by the branch. The results are summarised in Table 6.6.

Table 6.5

Summary of the investigation into the impact of special order sizes

(Simulated figures where $c_2 = 10\ c_1$ and Q = 750 000)

Safety stock	Special order size	Order quantity	Optimum reorder point	Daily cost
SS = 200 000 (Appendix J-4-2)	SQ = 500 000	Q = 750 000	ROP = 900 000	R2 831
SS = 500 000 (Appendix J-5-2)	SQ = 500 000	Q = 750 000	ROP = 800 000	R2 863
SS = 1 000 000 (Appendix J-6-2)	SQ = 500 000	Q = 750 000	ROP = 300 000	R2 911
SS = 200 000 (Appendix L-1-1)	SQ = 750 000	Q = 750 000	ROP = 700 000	R2 820
SS = 500 000 (Appendix L-1-2)	SQ = 750 000	Q = 750 000	ROP = 500 000	R2 830
SS = 1 000 000 (Appendix L-1-3)	SQ = 750 000	Q = 750 000	ROP = 300 000	R2 884
SS = 200 000 (Appendix L-2-1)	SQ = 1 000 000	Q = 750 000	ROP = 700 000	R2 815
SS = 500 000 (Appendix L-2-2)	SQ = 1000 000	Q = 750 000	ROP = 500 000	R2 843
SS = 1 000 000 (Appendix L-2-3)	SQ = 1 000 000	Q = 750 000	ROP = 300 000	R2 892

Table 6.6

Proposed special order sizes applied to actual amounts

(c_2 = 10 c_1 and Q = 750 000)

Policy	Cost		Number of orders		Number of shortages
	Total	Daily	Normal	Special	
SQ = 500 000					
SS = 200 000 ROP = 900 000	R 224 435	R2 466	16	2	0
SS = 500 000 ROP = 800 000	R 233 858	R2 570	13	7	1[2]
SS = 500 000 ROP = 900 000	R 231 672	R 2 546	14	5	0
SS = 1 000 000 ROP = 300 000	R 236 419	R 2 598	1	24	0
SQ = 750 000					
SS = 200 000 ROP = 700 000	R 231 153	R 2 540	13	5	2[2]
SS = 200 000 ROP = 900 000	R 231 866	R 2 548	16	2	0
SS = 500 000 ROP = 500 000	R 228 798	R 2 514	9	9	1[3]
SS = 500 000 ROP = 700 000	R 225 506	R 2 478	12	5	0
SS = 1 000 000 ROP = 300 000	R 237 774	R 2 613	1	17	0
SQ = 1 000 000					
SS = 200 000 ROP = 700 000	R 228 403	R 2 510	13	4	0
SS = 500 000 ROP = 1 000 000	R 242 067	R 2 660	12	5	0
SS = 1 000 000 ROP = 300 000	R 239 685	R 2 634	1	13	0

2. Since shortages are not acceptable, the next reorder point level which prevents shortages is found. This reorder point is R900 000.
3. Since shortages are not acceptable, the next reorder point level which prevents shortages is found. This reorder point level is R700 000.

Based on the results of Table 6.6, no further reduction beyond the 10% achieved by an order policy using a safety stock level of R200 000, a reorder point of R900 000, a special order size of R500 000 and an order quantity of R750 00 was possible. These calculations were based throughout on the assumption that the shortage cost is ten times the storage cost.

6.4.2.4 Returning excessive cash amounts to SBV

The branch does not return excess cash amounts to SBV. Instead, the cash is carried at the branch until required. Since the average total withdrawals at this particular branch exceeds the average deposits, this situation is tenable. Over time the excess cash will be employed.

The question which arises, however, concerns the storage cost associated with this approach. It implies that large amounts of cash will be carried at the branch for extended periods. If Appendix D1 is studied, the observation may be made that the amount of cash on hand peaks at R2 700 000 on a number of occasions. On only three days during the three month period under review, was the amount of cash on hand below R1 000 000.

Using the best policy identified thus far, the impact of returning excess amounts of cash to SBV is investigated. The policy which has provided the lowest cost option in the preceding paragraphs, prescribes an order quantity of R750 000, a safety stock level of R200 000 and special order size of R500 000. This policy was selected under the assumption that the shortage cost (c_2) is equal to ten times the storage cost (c_1). In addition, a safety stock level of R500 000 was investigated.

During the investigation, the reorder point was varied between R300 000 and R2 000 000 for an upper limit of R2 000 000 and R2 500 000. Trial and error proved that only a return amount of R500 000 seemed at all feasible, therefore only this option was investigated fully as shown in Appendix M. The lead time for returns was assumed to be two days. The results of the investigation shown in Table 6.7, are based on the simulated figures as before. The abbreviation RA is used to denote return amount and UL to indicate the upper limit.

Table 6.7

Summary of the investigation into the effect of returning excess cash

(Simulated figures where $c_2 = 10c_1$, Q = 750 000, SQ = 500 000 and RA = 500 000)

Upper limit	Optimum reorder point	Daily cost
SS = R200 000		
R 2 000 000 (Appendix M-1-1)	ROP = 1 600 000	R3 136
R 2 500 000 (Appendix M-1-2)	ROP = 1 100 000	R2 856
SS = 500 000		
R 2 000 000 (Appendix M-2-1)	ROP = 1 400 000	R3 072
R 2 500 000 (Appendix M-2-2)	ROP = 900 000 ROP = 1 100 000	R2 877 R2 893

From Table 6.7 it is obvious that an upper limit of R2 500 000 combined with a safety stock level of R200 000 and a reorder point of R1 100 000 provides the best alternative for a special order size of R500 000, a R500 000 return amount and a reorder quantity of R750 000. It is important to note the effect that returning excess cash amounts has on the number of orders as shown in Appendix M. The number of normal and special orders, as well as the shortages increased markedly. As before this approach is tested against the actual figures. The results are shown in Table 6.8.

Table 6.8 shows that a policy prescribing an upper limit of R2 500 000 combined with a safety stock level of R500 000 leads to a situation where no returns are made. An upper limit of R2 000 000 in both cases (safety stock equal to R200 000 or R500 000) would lead to many returns, compared to the number of orders placed.

Based on Table 6.8, the cost could be reduced significantly from current levels at the branch, but no further reductions were possible beyond the 10% reduction achieved earlier in the chapter where returns were not considered. These results, combined with the theoretically confirmed characteristic of the total cost curve in analysing inventory costs, of flatness in the optimum region, lead to the decision to perform a full analysis on the actual figures, similar to the analyses performed thus far on the simulated figures.

Table 6.8

Proposed return amounts and upper limits applied to actual amounts

(c_2 = 10 c_1, Q = 750 000 and SQ = 500 000)

Policy	Cost		Number of orders		Number of shortages	Number of returns
	Total	Daily	Normal	Special		
SS = 200 000						
UL = 2 000 000 ROP = 1 600 000	R 258 853	R2 845	34	0	0	25
UL = 2 500 000 ROP = 1 100 000	R 233 533	R2 566	19	0	0	2
SS = 500 000						
UL = 2 000 000 ROP = 1 400 000	R 256 695	R 2 821	30	4	0	21
UL = 2 500 000 ROP = 900 000	R 231 672	R 2 546	14	5	0	0
UL = 2 500 000 ROP = 1 100 000	R 233 596	R 2 567	17	1	0	0

6.4.2.5 The "best" order policy

As explained before, various combinations of the parameters are applied to the actual figures in an attempt to verify the conclusions reached in this chapter and to identify a "best" policy for the branch which will minimise the cost of holding inventory without compromising customer service. The full results of the investigation are shown in Appendix N. A summary of the results appear in Table 6.9. The analysis was based on an order quantity of R750 000, a special order size of R500 000 and a return amount of R500 000.

Appendices N1 to N4 show that the investigation based on the simulated figures (reported in Table 6.7) did not point out the true minimum cost alternative when applied to the actual amounts. A full investigation as shown in Appendix N suggests lower reorder point levels. This is reflected in Table 6.9.

Table 6.9

Summary of "best" policies

(c_2 = 10 c_1, Q = 750 000, SQ = 500 000, RA = 500 000)

Policy	Cost		Number of orders		Number of shortages	Number of returns
	Total	Daily	Normal	Special		
SS = 200 000						
UL = 2 000 000 ROP = 900 000 (Appendix N-1)	R231 186	R2 541	22	2	0	9
UL = 2 500 000 ROP = 900 000 (Appendix N-2)	R224 435	R2 466	16	2	0	0
SS = 500 000						
UL = 2 000 000 ROP = 500 000	R228 096	R 2 507	12	12	0	4
UL = 2 500 000 ROP = 900 000	R231 672	R 2 546	14	5	0	0

From Table 6.9 the "best" policy corresponds to the policy identified in Table 6.4, *i.e.* an order quantity of R750 000, a special order size of R500 000, a safety stock level of R200 000 and a reorder point of R900 000. Since this policy, when combined with the possibility of returning excess cash amounts, did in fact not lead to any returns. However, this does not imply that excess cash should not be returned. In Table 6.4, a second "best" policy provided the same daily cost, however, using a reorder point of R300 000. If this reorder level is combined with a return amount of R500 000 and an upper limit of R2 500 000 (with all other parameters as before), it provides the same results as the policy using a safety stock level of R200 000.

6.4.2.6 Lead time

During discussions with the operations manager at the branch, it was pointed out that the deliveries from SBV often arrived after or very close to the end of a trading day, thereby lengthening the lead time for normal orders to three days and that for special orders to two days. In Appendix O the three "best" policies identified in the preceding paragraphs were tested for further cost reductions should the extended lead times be used. From Appendix O it is obvious that none of these policies would have been feasible since at all reorder levels shortages would have occurred. In addition, all policies lead to an increase in the daily cost of holding cash inventory. The policies identified in the previous paragraph were therefore accepted as being the "best" based on the analyses performed.

6.5 Conclusion

In this chapter it was proven that a cost reduction could be achieved by altering the existing policy of ordering cash at the branch. However, in ordering the cash amounts, cognisance was not taken of the seasonality of the data. In the next chapter, the results of Chapter 5 will be combined with the results of Chapter 6 to propose a decision support system to optimise the order policy employed at the branch.