CHAPTER 4

RELATIONSHIP BETWEEN LEVERAGE AND EVA AND MVA

4.1 INTRODUCTION

The objective of this chapter is to link management accounting techniques such as variable costing and cost-volume-profit analysis with financial management techniques such as leverage analysis and value analysis in order to determine how decisions or changes in input will affect the shareholder value. The leverage effect of the cost of equity is introduced as a new concept and it is illustrated how it reacts in conjunction with operating leverage and financial leverage to determine the total overall leverage of the company.

This new approach would be useful for decision-making purposes in assessing the impact of different decision alternatives such as the viability of marketing campaigns, changes in product combinations and capital expansion projects. Furthermore, the new approach will be useful in determining the effect of changes in internal factors like production costs or external factors like inflation and tax rates on profits and shareholder value. The findings of this analysis could be of value to managers at all levels in a business organisation, but especially to financial managers. Existing shareholders and potential investors would also benefit from the use of these techniques, but the company data required as inputs for the model would not be available to shareholders.

The determination of EVA and MVA was discussed in Chapter 3. The concept of leverage is now discussed briefly, followed by an illustration of the development and

use of a spreadsheet model to extend the leverage analysis of profits to EVA and MVA. The leverage effect of the cost of equity on EVA and MVA is investigated. The initial hypothesis is that, similar to fixed costs and interest, the cost of equity also has a leverage effect on the profits (and EVA and MVA) of a business. It should be possible to quantify this leverage effect and to use it, together with the well-known operating leverage and financial leverage factors, to determine the total leverage for a company. Once the total leverage has been determined, it would be possible to predict what effect any change in input would have on profits, EVA and MVA.

An attempt is made to derive a formula (given certain assumptions) to predict what effect a particular change in volume (sales) would have on EVA and MVA. Finally, the impact of different levels of operating and financial leverage on profits, EVA and MVA is evaluated.

4.2 OPERATIONAL LEVERAGE, FINANCIAL LEVERAGE AND TOTAL LEVERAGE

"Operational leverage" (Correia *et al.* 2003; Gitman 2000; Ross *et al.* 1999) refers to the effect that fixed costs have on the volatility (and risk) of operating profits, given fluctuations in sales. The degree of operating leverage (DOL) is calculated as follows:

DOL = Contribution/Operating profit (after fixed costs)

where

Contribution = Sales minus all variable costs

The answer is a factor equal to one (in the case of zero fixed costs) or greater than one. A DOL factor of 1,8 means that for every 10% change in sales, the operating profit will change by 18% (all other things being equal).

Similarly, "financial leverage" refers to the effect of interest on debt on profits after interest, given fluctuations in sales. The degree of financial leverage (DFL) is calculated as follows:

DFL = Operating profit / Profit after interest

The answer is a factor equal to one (no interest) or greater than one and a DFL factor of 1,5 means that for every 10% change in operating profit, profit after interest changes by 15% (all other things being equal).

The combined effect, or "total degree of leverage" (TDL), is

TDL = DOL x DFL

or

TDL = Contribution / Profit after interest

A TDL of 1,8 x 1,5 = 2,7 means that for every 10% change in sales, the profit after interest changes by 27%.

4.3 LINK BETWEEN EVA, MVA AND LEVERAGE

In Section 3.9 of Chapter 3 it was indicated that, theoretically, MVA is equal to the PV of all future EVAs. On the assumption that there will be no future growth in the current EVA, or that the expected future growth in EVA will be at a constant rate, g, the theoretical MVA can be calculated as a perpetuity. The result shows that MVA is a multiple of the current EVA.

So, for example, Company A has a current EVA of R100 million. Its WACC is 20%. If no future growth in EVA is expected, the theoretical MVA can be calculated as follows:

MVA = PV (future EVA)
= current EVA / WACC

= R100 million / 0,2
= R500 million

In this instance, the MVA is five times the current EVA, or R500 million/R100 million.

If the EVA is expected to grow at a constant rate of 10% in future, the theoretical MVA can be calculated as follows:

MVA = PV(future EVA)
= current EVA / (WACC – g)
= R100 million / (0,2 – 0,1)
= R1000 million

With the assumption of 10% future growth in EVA, MVA is ten times the current EVA, or (R1000 million / R100 million). The fact that MVA is theoretically a multiple of the current EVA means that any percentage change in EVA should cause the same percentage change in MVA.

In Section 4.1 it was shown how the leverage effect of fixed costs and interest causes profits to change more dramatically than sales for a given percentage change in volume. If the cost of equity is subtracted from profits (after interest and tax), one gets EVA. If one assumes that the capital structure and the cost of equity percentage remain unchanged, the amount debited as the cost of equity in the calculation of EVA is a fixed amount. This fixed amount of the cost of equity also has a leverage effect that causes the EVA (and the theoretical MVA) to change more dramatically than profits when there are changes in the sales volume. The leverage effect of the cost of equity (referred to as EVA leverage) can now be investigated and combined with operational and financial leverage to study the effect on the profits and value of a business as a whole.

4.4 SPREADSHEET MODEL

A spreadsheet model was developed using different levels of operating leverage and financial leverage. The relationship between profits (after interest and tax) and EVA was determined. This was done by using the cost of own capital (equity) and this fixed amount can therefore be described as a leverage factor for EVA.

Furthermore, the EVA leverage factor was combined with the operating and financial leverage. It then became possible to illustrate how the expected percentage change in EVA and MVA can be predicted, given a certain percentage change in sales (or profits). The results of the model, using different scenarios (levels of leverage) were then analysed to reach conclusions and to allow some recommendations to be made.

4.5 MODEL ASSUMPTIONS AND INPUTS

The model assumptions and inputs are contained in Schedule A and are discussed briefly below. It was assumed that a company has “operational assets” consisting of fixed assets and net current assets of R2 million. These are financed by 60% equity capital and 40% long-term debt. This model is described as “average” financial gearing and it is also the optimal capital structure, yielding the lowest WACC of 17,4 %. The cost of equity at this level of gearing is assumed to be 22% and the after-tax cost of debt is 10,5%.

A tax rate of 30% and a return on assets before tax of 35% (24,5% after tax) are assumed. Furthermore, an asset turnover of 1 is assumed; meaning that the total assets of R2 million will yield sales of R2 million. The cost structure of variable costs of 40% of sales and fixed costs of R500 000 per year are considered “average”.

In order to look at the effect of different cost structures (operational leverage), a high fixed cost structure was regarded as one where the variable costs are only 25% of sales and fixed costs are R800 000 per year. A “low” fixed cost structure

was one where the variable costs are 55% of sales and the fixed costs are R200 000 per year.

The financial structure was also changed to illustrate the effect of different levels of financial leverage. As mentioned above, the optimal structure of 60% equity and 40% debt (WACC = 17,4%) is called “average” financial gearing. “High” financial gearing is the situation where 40% equity and 60% debt are used, giving a WACC of 18,1%. “Low” financial gearing was indicated by 80% equity and 20% debt, also giving a WACC of 18,1%. This points toward the fact that the WACC increases when the financial gearing changes to levels above or below the optimal level.

The model was based on the assumption that operating efficiencies, as indicated by measures such as the asset turnover, remain the same and that there is no inflation. Fixed costs therefore remain the same in the total amount and variable costs remain the same percentage of sales.

Different scenarios (as specified in Table 4.1) were created to identify the effects of gearing on profits, EVA and MVA.

Table 4.1: Assumptions and input items of spreadsheet model

1.	Capital structure (ave. fin. gearing)	Amount	Weight	Cost	Weighted
	Equity	R1 200 000	60%	22,00%	13,20%
	Debt	R800 000	40%	10,50%	4,20%
	Total assets	R2 000 000		**WACC**	17,40%
2.	Tax rate				30,00%
3.	Return on assets before interest and tax				35,00%
4.	Return on assets after tax				24,50%
5.	Interest rate before tax				15,00%
6.	Interest rate after tax				10,50%
7.	Asset turnover (total sales / total assets)				1
8.	Variable costs as percentage of sales				40,00%
9.	Fixed costs per year (for average level of operating leverage)				R500 000
10.	MVA assumption 1: EVA remains same in perpetuity (no growth)				
11.	MVA assumption 2: Constant EVA growth, growth percentage (note 1)				5,00%
12.	MVA assumption 3: Abnormal growth year 1-5, growth percentage				15,00%
13.	Total assets = Fixed assets + net current assets				
14.	Average capital structure: 60% equity and 40% debt is optimal (WACC 17,4%)				
15.	"High leverage" 40% equity and 60% debt (K_{equity} = 29,5%; WACC = 18,1%)				
16.	"Low leverage" 80% equity and 20% debt (K_{equity} = 20%; WACC = 18,1%)				
17.	Fixed costs "Average" = R500 000, Variable costs 40% of sales = R800 000				
	"High" = R800 000, variable costs 25% of sales = R500 000				
	"Low" = R200 000, variable costs 55% of sales = R1 100 000				

18. Scenarios:

	Fixed costs	Financial gearing
1	Average	Average (optimal)
2	High	Low
3	High	High
4	Low	Low
5	Low	High

Note 1: If EVA is negative at the outset (base case), constant growth causes EVA to become more negative in future.

4.6 MODEL OUTPUT AND LEVERAGE FACTORS

Table 4.2 shows the calculation of profits, EVA, MVA as well as the leverage factors for Scenario 1 where average levels of operating leverage and financial leverage are maintained.

- Sales minus the variable costs give the contribution. When the fixed costs are subtracted from the contribution, the result is net operating profit.
- Next the interest is subtracted to give profit before tax and after subtracting the tax, the profit after tax remains. In order to calculate the EVA, the cost of own capital is subtracted from profit after tax.
- The cost of equity is calculated as 22% x R1 200 000 = R264 000. An alternative calculation, using the WACC, is used to confirm the EVA.

The MVA is calculated in three ways, allowing for three different assumptions about future growth in EVA. The first version of MVA (MVA_1) is calculated as if there will be no future growth in EVA. The calculation is simply this:

MVA_1 = EVA / WACC, or R142 000 / 0,174 = R816 092.

The second version of MVA (MVA_2) assumes a constant future growth rate of 5% in EVA. The calculation is as follows:

MVA_2 = EVA (1 + g) / (WACC – g)

(R142 000 x 1,05) / (0,174 – 0,05) = R1 202 419.

The third version of MVA (MVA_3) assumes an abnormal growth rate in EVA of 15% for the first five years and a constant growth rate of 5% after that. The calculation of MVA_3 projects the future EVAs at the abnormal growth rate of 15% for the first five years and then at 5% in perpetuity.

MVA_3 = R142 000 (1,15) / 1,174 + R142 000 $(1,15)^2$ / $1,174^2$ + R142 000 $(1,15)^3$ / $1,174^3$ + R142 000 $(1,15)^4$ / $1,174^4$ + R142 000 $(1,15)^5$ / $1,174^5$ + [R142 000 $(1,15)^5$ x (1,05) / (0,174 – 0,05)] / $1,174^5$ = R1 752 063.

As a check for the reasonableness of this calculation, the total market value of equity was calculated and divided by the book value to give the market : book ratio. The ratios calculated for all three versions of MVA range from 1,68 to 2,46 and are considered reasonable. Another test for reasonableness is the MVA/EVA multiple. It ranges from 5,75 for MVA_1 to 12,34 for MVA_3. This is in line with the research findings of Stern Stewart Consulting Company, cited by Ehrbar (1998:78) namely that “each $1 increase in EVA brings, on average, a $9,50 increase in MVA”.

Table 4.2a

Base case scenario 1: Average fixed costs and average financial gearing

Income Statement and EVA and MVA	**Current**
Sales	R2,000,000
Variable costs	R800,000
Contribution	R1,200,000
Fixed costs	R500,000
Net operating profit	R700,000
Interest	R120,000
Profit before tax	R580,000
Tax	R174,000
Profit after tax	R406,000
Cost of equity	R264,000
EVA	R142,000

Confirmation of EVA calculation:

EVA	=	Return Spread x IC
	=	(ROIC – WACC) x IC
	=	(24,5% - 17,4%) x R2 million
	=	7,1% x R2 million
	=	R142 000

		MVA/EVA Multiple	**Tot Assets**	**Tot MV**	**MV Debt**	**MV Equity**	**BV Equity**	**Market/ Book**
MVA_1 (Current EVA in perpetuity; no growth)	R816,092	5.75	R2,000,000	R2,816,092	R800,000	R2,016,092	R1,200 000	1.68
MVA_2 (Constant growth % in EVA)	R1,202,419	8.47	R2,000,000	R3,202,419	R800,000	R2,402,419	R1,200,000	2.00
MVA_3 (Abnormal growth in year 1-5; then constant)	R1,752,063	12.34	R2,000,000	R3,752,063	R800,000	R2,952,063	R1,200,000	2.46
Calculation: Period 1 EVA, abnormal growth	R163,300							
Period 2	R187,795							
Period 3	R215,964							
Period 4	R248,359							
Period 5	R285,613							
Period 5 Constant growth in perpetuity	R2418,495							
DOL = Contribution/ Operating profit	1.7143							
DFL = Operating profit/Profit after interest	1.2069							
TDL = DOL x DFL	2.0690							
EVA leverage factor = Profit after tax/EVA	2.8592							
Total leverage including EVA = TDL x EVA leverage	5.9155							

Table 4.2b

Scenario 1: Average fixed costs and average financial gearing

Income Statement and EVA and MVA	**Sales – 20%**	**Sales – 10%**	**Current**	**Sales + 10%**	**Sales + 20%**
Sales	R1,600,000	R1,800,000	R2,000,000	R2,200,000	R2,400,000
Variable costs	R640,000	R720,000	R800,000	R880,000	R960,000
Contribution	R960,000	R1,080,000	R1,200,000	R1,320,000	R1,440,000
Fixed costs	R500,000	R500,000	R500,000	R500,000	R500,000
Net operating profit	R460,000	R580,000	R700,000	R820,000	R940,000
Interest	R120,000	R120,000	R120,000	R120,000	R120,000
Profit before tax	R340,000	R460,000	R580,000	R700,000	R820,000
Tax	R102,000	R138,000	R174,000	R210,000	R246,000
Profit after tax	R238,000	R322,000	R406,000	R490,000	R574,000
Cost of equity	R264,000	R264,000	R264,000	R264,000	R264,000
EVA	-R26,000	R58,000	R142,000	R226,000	R310,000
MVA_1 (Current EVA in perpetuity; no growth)	-R149,425	R333,333	R816,092	R1,298,851	R1,781,609
MVA_2 (Constant growth % in EVA)	-R220,161	R491,129	R1,202,419	R1,913,710	R2,625,000
MVA_3 (Abnormal growth in year 1-5; then constant growth)	-R311,345	R694,539	R1,700,423	R2,706,308	R3,712,192
Calculation: Period 1 EVA, abnormal growth:	-R29,900	R66,700	R163,300	R259,900	R356,500
Period 2	-R34,385	R76,705	R187,795	R298,885	R409,975
Period 3	-R39,543	R88,211	R215,964	R343,718	R471,471
Period 4	-R45,474	R101,442	R248,359	R395,275	R542,192
Period 5	-R52,295	R116,659	R285,613	R454,567	R623,521
Period 5 Constant growth in perpetuity	-R421,736	R940,796	R2,303,328	R3,665,861	R5,028,393

Test: For every 10% change in Sales:

Operating profit changes by:	17.143% (leverage effect of fixed operating costs)
Profit after interest and tax by:	20.690% (leverage effect of fixed operating costs & interest)
EVA by:	59.155% (leverage effect of fixed operating costs, interest and cost of equity)
MVA (multiple of EVA) by:	59.155% (leverage effect of fixed operating costs, interest and cost of equity)

Table 4.3

All scenarios

Income Statement and EVA and MVA	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**
Sales	R2,000,000	R2,000,000	R2,000,000	R2,000,000	R2,000,000
Variable costs	R800,000	R500,000	R500,000	R1,100,00	R1,100,00
Contribution	R1,200,000	R1,500,000	R1,500,000	R900,000	R900,000
Fixed costs	R500,000	R800,000	R800,000	R200,000	R200,000
Net operating profit	R700,000	R700,000	R700,000	R700,000	R700,000
Interest	R120,000	R60,000	R180,000	R60,000	R180,000
Profit before tax	R580,000	R640,000	R520,000	R640,000	R520,000
Tax	R174,000	R192,000	R156,000	R192,000	R156,000
Profit after tax	R406,000	R448,000	R364,000	R448,000	R364,000
Cost of equity	R264,000	R320,000	R236,000	R320,000	R236,000
EVA	R142,000	R128,000	R128,000	R128,000	R128,000
MVA_1 (Current EVA in perpetuity; no growth)	R816,092	R707,182	R707,182	R707,182	R707,182
MVA_2 (Constant growth % in EVA)	R1,202,419	R1,025,954	R1,025,954	R1,025,954	R1,025,954
MVA_3 (Abnormal growth in year 1-5; then constant growth)	R1,752,063	R1,489,520	R1,489,520	R1,489,520	R1,489,520
Calculation: Period 1 EVA, abnormal growth:	R163,300	R147,200	R147,200	R147,200	R147,200
Period 2	R187,795	R169,280	R169,280	R169,280	R169,280
Period 3	R215,964	R194,672	R194,672	R194,672	R194,672
Period 4	R248,359	R223,873	R223,873	R223,873	R223,873
Period 5	R285,613	R257,454	R257,454	R257,454	R257,454
Period 5 Constant growth in perpetuity	R2,418,495	R2,063,560	R2,063,560	R2,063,560	R2,063,560
DOL = Contribution / Operating profit	1.7143	2.1429	2.1429	1.2857	1.2857
DFL = Operating profit / Profit after interest	1.2069	1.0938	1.3462	1.0938	1.3462
TDL = DOL x DFL or Contribution / Profit after interest	2.0690	2.3438	2.8846	1.4063	1.7308
EVA leverage factor = Profit after tax / EVA	2.8592	3.5000	2.8438	3.5000	2.8438
Total leverage including EVA = TDL x EVA leverage	5.9155	8.2031	8.2031	4.9219	4.9219

The leverage factors were calculated as follows:

DOL = contribution / operating profit
= 1 200 000 / 700 000
= 1,7143

This means that for every 1% change in sales (or contribution), the Operating Profit changes by 1,7143%.

DFL = operating profit / profit after interest
= 700 000 / 580 000
= 1,2069

This means that for every 1% change in Operating Profit, Profit After Interest changes by 1,2069%.

TDL = DOL x DFL
= 1,7143 x 1,2069
= 2,0690

This means that for every 1% change in sales (or contribution) the Profit After Interest changes by 2,0690%.

When EVA is calculated, the cost of own capital is a fixed charge that also represents a leverage factor that causes the EVA and MVA to fluctuate more drastically than a given percentage change in sales. This “EVA” leverage effect is caused by the cost of own capital (equity) and is calculated as follows:

EVA leverage = profit after interest and tax / EVA
= 406 000 / 142 000
= 2,8592

This means that for every 1% change in profit after interest and tax, EVA changes by 2,8592%. If this is combined with the TDL already calculated, then

Total leverage including EVA	= TDL x EVA leverage factor, or
	= contribution x (1 – tax rate) / EVA
	= 2,0690 x 2,8592
	= 5,9155

This means that for every 1% change in sales (or contribution), EVA (and MVA) changes by 5,9155%. Because MVA is a multiple of EVA, the percentage change in MVA is the same as that for EVA, given a certain percentage change in sales.

In Table 4.2b the effect of changes of –20%; -10%; +10% and +20% on sales was calculated to verify the correctness of the leverage factors for Scenario 1. The inputs of the spreadsheet set out in Table 4.1 were then changed for each of the other scenarios (2 to 5). The results are summarised in Table 4.3. Due to the repetitive nature of the exercise for each scenario, the equivalent spreadsheets for the other scenarios are not included here.

4.7 RESULTS OF THE ANALYSIS

The different levels of operating leverage for each of the five scenarios are set out in Figure 4.1. It is obvious that the operational leverage factors (as a result of fixed costs) are highest for Scenarios 2 and 3. Figure 4.2a shows the DFL for each scenario. Scenarios 3 and 5 stand out as those with the highest DFL (on account of their high level of long-term debt).

Figure 4.1: DOL for each scenario

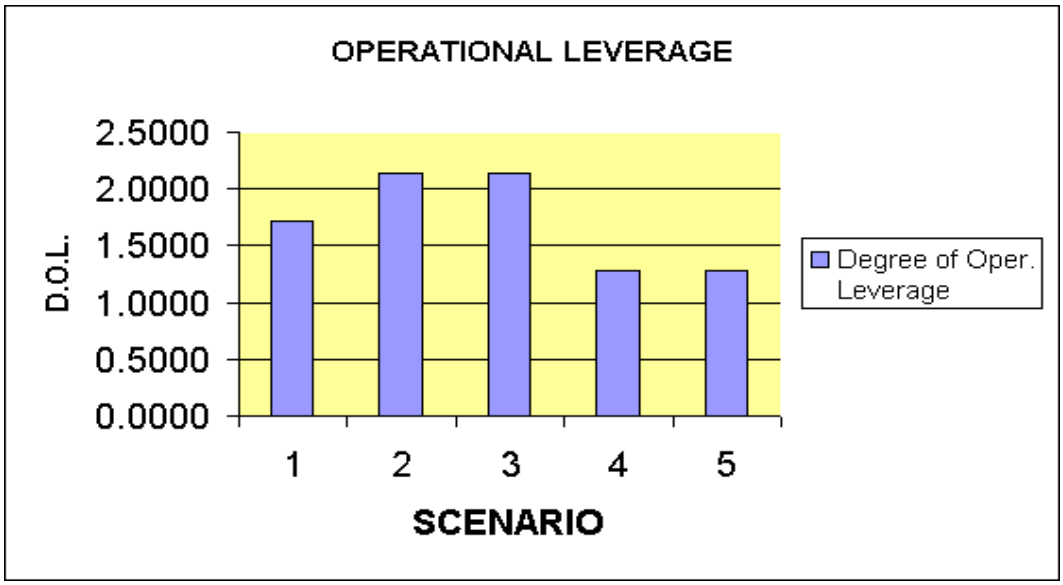
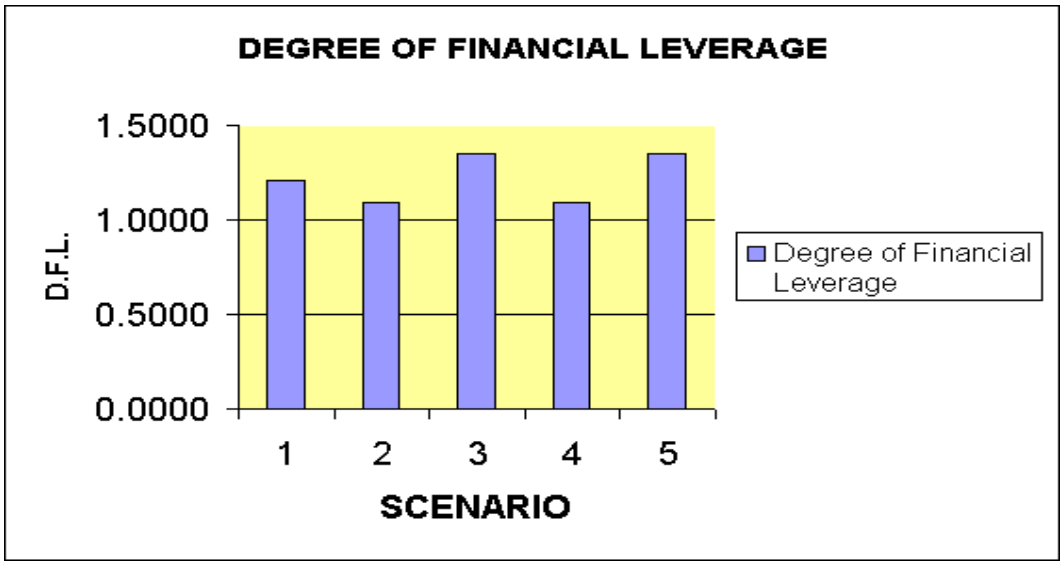


Figure 4.2: DFL for each scenario



As the degree of EVA leverage is dependent on the size of own (equity) funding, one would expect this leverage factor to contrast with the financial leverage situations. This expectation is borne out by Figure 4.3, which shows that the degree of EVA leverage is indeed highest for those scenarios where the financial gearing is low, namely Scenarios 2 and 4. It is interesting to note that the degree of EVA

leverage is the same for the same level of financial gearing, Scenarios 2 and 4 (high) and Scenarios 3 and 5 (low).

Figure 4.3: Degree of EVA leverage for each scenario

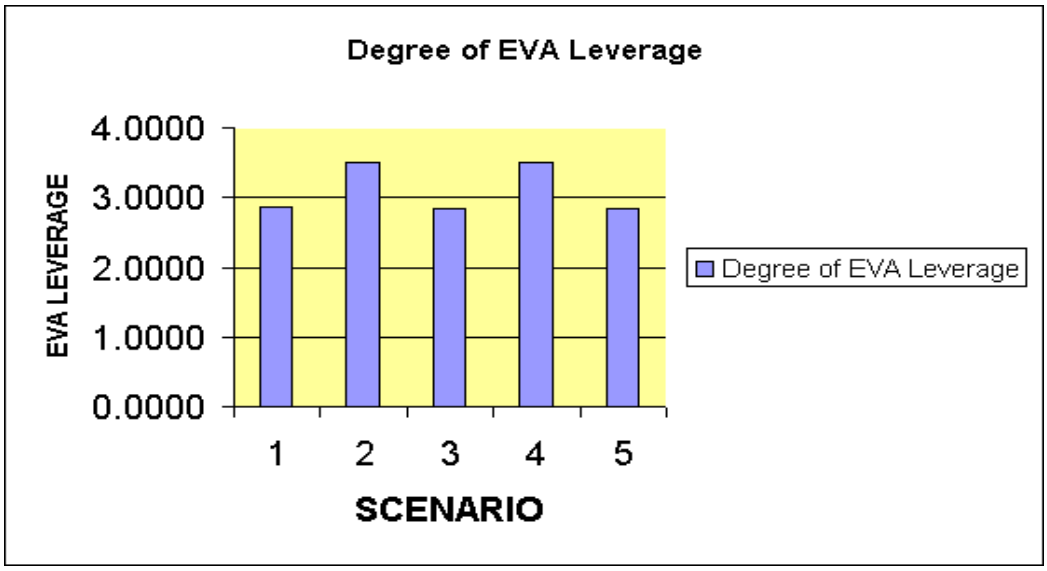


Figure 4.4: Total leverage including EVA for each scenario

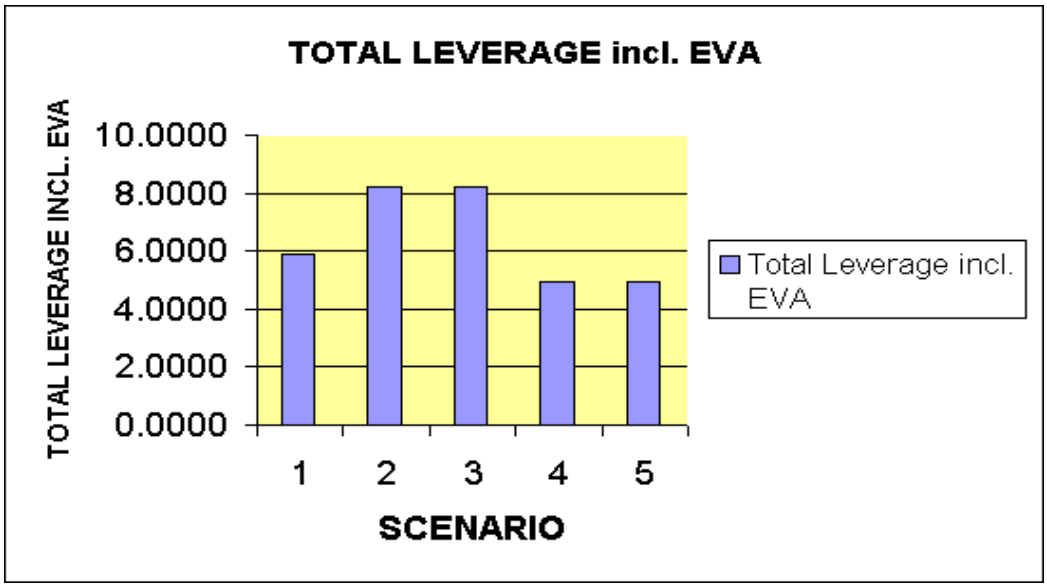


Figure 4.4 shows the total degree of leverage, including EVA. The scenarios with the highest total leverage, including EVA factors, are Scenarios 2 and 3, which also have the highest levels of fixed costs. Furthermore, the total leverage including EVA

factors is considerably lower for scenarios with low fixed costs, such as Scenarios 4 and 5. In addition, the factors are the same for scenarios with the same level of fixed costs, namely Scenarios 2 and 3 (high) and Scenarios 4 and 5 (low). From this one can conclude that the total degree of leverage including EVA is not affected by the financial gearing, but only by the operational gearing (given that the WACC is the same for the different levels of financial gearing).

Figure 4.5: Effect of changes in sales on net operating profit

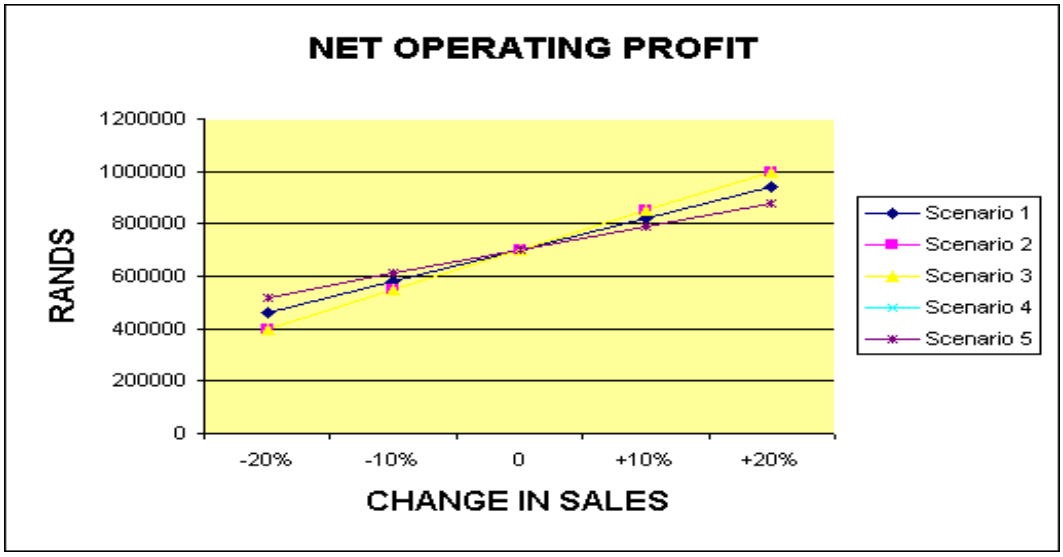


Figure 4.6: Effect of changes in sales on profit after tax and interest

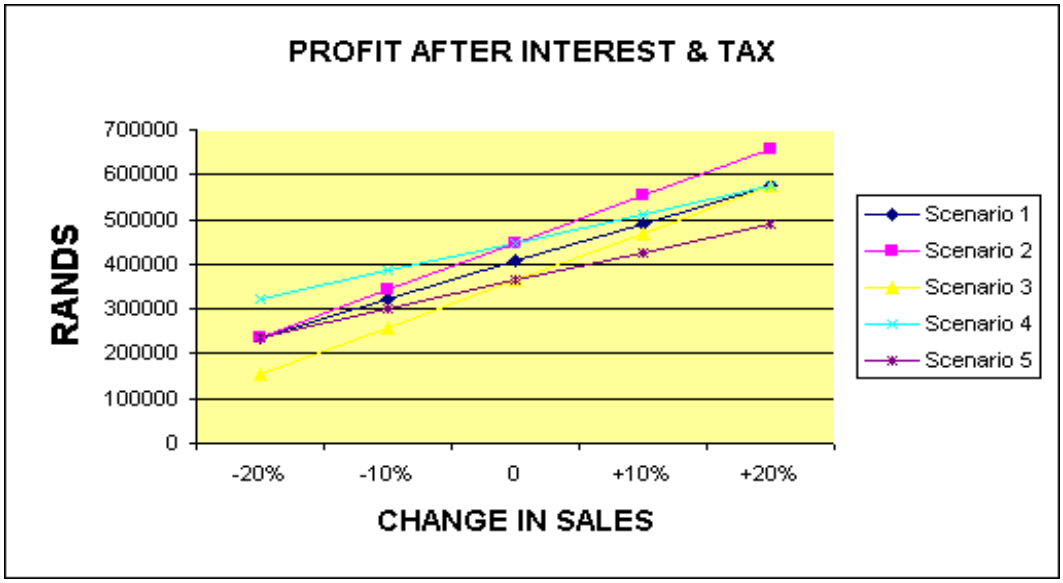


Figure 4.5 indicates the effect of operational leverage. It shows that the effect of a change in sales is more drastic for scenarios with higher fixed costs, namely Scenarios 2 and 3, than for the other scenarios. Figure 4.6 shows the combined effect of operational leverage and financial leverage on profit after interest and tax. As expected, the greatest volatility was found in the scenarios with the highest total degree of leverage, namely Scenarios 2 and 3.

Figure4.7: Effect of changes in sales on EVA

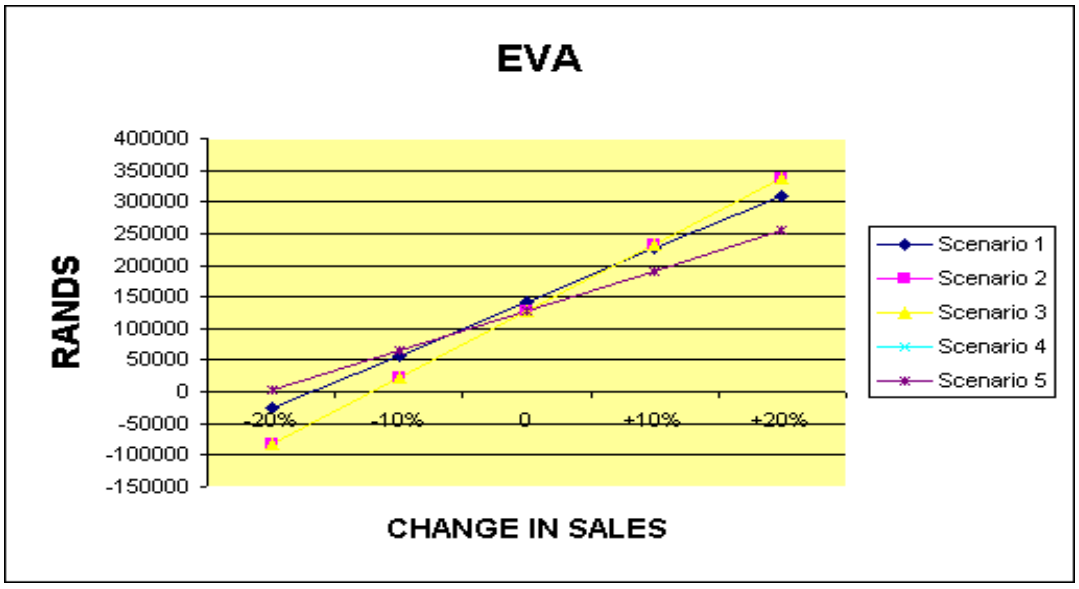


Figure 4.8: Effect of changes in sales on MVA

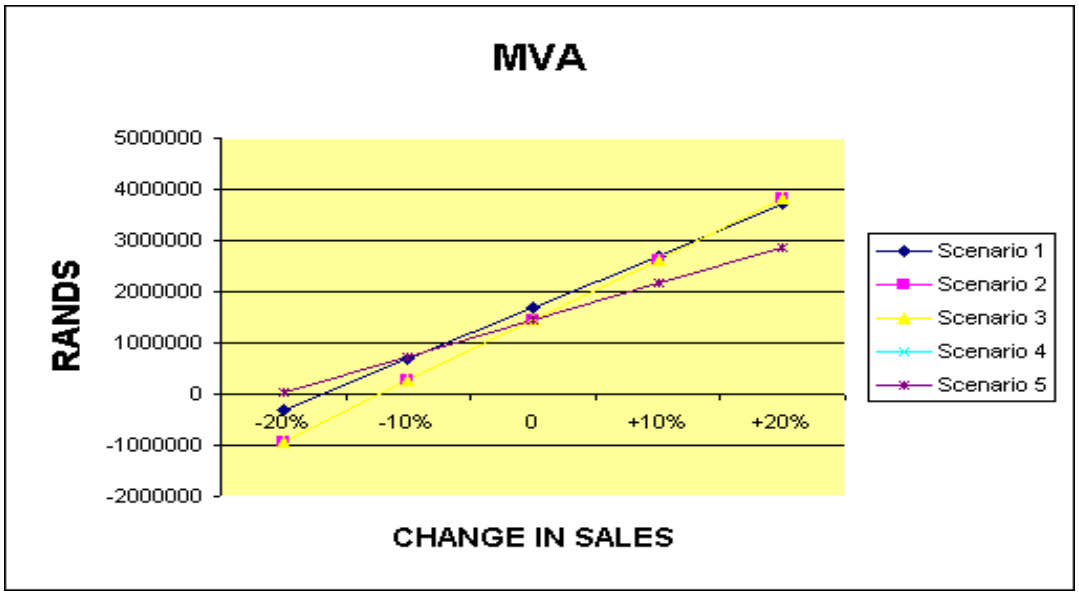


Figure 4.7 shows the effect of changes in sales on EVA. As expected, the scenarios with the highest total leverage including EVA, namely Scenarios 2 and 3, showed the greatest volatility in EVA for changes in sales. Finally, Figure 4.8 shows the effect of changes in sales on MVA_3. Again, the scenarios that were the most volatile were the ones with the highest total leverage including EVA, namely Scenarios 2 and 3.

4.8 CONCLUSION

The spreadsheet model was used to investigate the leverage effect of three items, namely fixed costs (DOL), interest on borrowed capital (DFL) and the cost of own capital (EVA leverage). Five different scenarios, each with a different level of DOL, DFL or EVA leverage, were assumed to determine the relationships (if any) between the different kinds of leverage as well as their impact on profits, EVA and MVA (and therefore, also the value of the firm).

The results indicated that the size of the total level of leverage including EVA is determined by all three elements causing the leverage. However, there was no difference in the total leverage including EVA for scenarios where only the financial gearing differed. The analysis showed that the effect of high financial leverage is offset perfectly by the lower cost of own capital (EVA leverage). Stated differently, the total leverage including EVA is the same for all scenarios with the same fixed costs (only if WACC remains constant).

Given the assumptions made, one can conclude that the organisation's sensitivity to changes in sales volume is determined by its degree of operational leverage and by its total cost of capital (as represented by the financial leverage and EVA leverage). The way the company is financed (assuming there is no change in the WACC) will not affect this total leverage effect.

It is recommended that companies make use of the suggested spreadsheet model in order to investigate and analyse the effects of changes in sales and other input items (such as selling prices, costs and the cost of capital) on the crucial

performance measures of EVA and MVA. As illustrated, these changes in EVA and MVA represent a direct quantification of shareholder value creation. The techniques discussed can be applied in performance measurement, valuations, cost/volume/profit analysis, sensitivity analysis, value management and scenario planning. The techniques can even be used to develop a performance-based reward system for all the employees of a company that create value for its shareholders (a company that has a positive EVA).

Further research could focus on the effect that other factors, such as changes in the financial structure and costs, would have on EVA and MVA. Empirical studies could be conducted by using the data of listed companies to investigate these leverage effects in practice, and by using the suggested spreadsheet model.

This chapter has related the concepts of EVA and MVA to leverage and investigated the effect of changes in sales on operating profits, profit after interest, EVA and MVA. The next chapter discusses the components that determine EVA.