CHAPTER 8

STATISTICAL TESTS OF THE VALIDITY OF THE FINANCIAL MATRIX MODEL AND THE MAIN DRIVERS OF EVA

8.1 INTRODUCTION

In the preceding chapter, specific companies, sectors and all companies as a group were placed on the financial strategy matrix in order to determine trends over time as well as appropriate future financial strategies, given a certain position on the matrix. This chapter discusses the results of statistical tests and regressions used to test what impact the two performance measures used for the financial strategy matrix (spreads and sales growth minus the SGR percentage) have on shareholder value.

Linear regression analysis was used to determine the impact of the main components (drivers) of EVA on MVA and changes in MVA. If they can identify the specific drivers that have the biggest impact on MVA, this will enable financial managers to narrow down their focus to those drivers that will unlock and increase the most value for shareholders.

From the outset it must be borne in mind that MVA and changes in MVA are external measures that are affected by external factors (to a very large extent) and also by internal factors, for instance, EVA and sales growth. Shareholders' expectations affect MVA and changes in MVA dramatically and therefore changes in the environment, such as political instability, have a vast effect on these measures. Consequently, it is to be expected that the impact of internal factors does not carry very much weight, especially in the short term.

8.2 THE IMPACT OF SPREADS AND SALES GROWTH MINUS THE SGR PERCENTAGE ON MVA AND CHANGES IN MVA

The goal of this statistical test was to assess the impact of spreads and the differential of sales growth minus the SGR percentage on MVA. Bearing in mind that both spreads and sales growth minus the SGR percentage are single-year, *relative* measures of performance, compared to MVA, which is a cumulative, *absolute* measure of performance, it was decided to replace MVA with a related, relative measure of performance for the purposes of the regression analysis.

The first proxy measure used in place of MVA was the “growth differential”, which is discussed in Section 8.2.1. The correlations of other proxies for MVA were also tested relative to spreads and sales growth minus the SGR percentage. In Section 8.2.2, the regression results are shown when the change in MVA (over the last year) is used in place of MVA. Section 8.2.3 contains the results of the regression analysis when the change in MVA divided by the IC (at the beginning of the year) is used.

8.2.1 Regression of spreads and sales growth minus the SGR percentage relative to the “growth differentials”

The measure chosen to replace MVA is the difference between the “implied expected growth in EVA” and the historical growth in EVA. The “implied expected growth in EVA” is based on the market’s expectation (as reflected by the independently determined MVA) of the current EVA and the future growth in the EVA of a company. This approach is analogous to the price-implied expectations (PIE) approach used by Rappaport and Mauboussin (2001:70).

In a nutshell, the PIE approach of Rappaport and Mauboussin (2001:70) entails using the information content of the market value of a share in conjunction with free cash flow projections to estimate the implied number of years it will take for the present value of the expected future cash flows to be equal to the market value of the company. The resulting number of years is then considered to determine whether the current share price represents reasonable value or not.

The following formula can be used as a basis for determining the "implied growth rate":

$$MVA = EVA\,(1 + g_i) / (WACC - g_i)$$

where

g_i = the implied expected future constant growth rate in EVA

When the MVA, EVA and WACC of a company is known (has been calculated), g_i can be determined by changing the formula, by multiplying the terms across as follows:

$$EVA + EVAg_i = MVA \times WACC - MVAg_i$$

$$EVAg_i + MVAg_i = MVA \times WACC - EVA$$

$$g_i(EVA + MVA) = MVA \times WACC - EVA$$

$$g_i = (MVA \times WACC - EVA)/(EVA + MVA)$$

When the historical growth rate in EVA is deduced from this "implied expected future growth rate", the difference is expected to be smaller for companies that are considered good performers (and bigger for those that are considered not to be good performers). A survey of the data for the listed companies included in the final database indicates that for the majority of these companies, the historical growth rate in EVA over the last number of years (1993 to 2002) was, with very few exceptions, consistently higher than the "implied expected growth rate".

Intuitively, this makes sense, because the market, as reflected by the MVA, is unlikely to expect EVA to keep on growing at the same rate as the most recent historical growth rate, and it is also unrealistic to expect this EVA growth to continue indefinitely in future. This view of the market aligns with the strategic perspective that, all other things being equal, the competitive advantage of a company is eroded over time as new competitors enter the market.

Therefore, if a linear regression is done between this "growth differential" and spreads, it is to be expected that there will be a negative correlation for companies performing well and a smaller, negative correlation for companies that are not performing well.

The "growth differential" for Pick'nPay, at the end of 2002 is calculated as follows:

Implied expected EVA growth rate:

MVA = EVA $(1 + g_i)/(\text{WACC} - g_i)$

4 467,027 = 215,69 $(1 + g_i)/(0{,}141 - g_i)$

g_i = 8,8%

Historical EVA growth rate:

$g_h = (\text{EVA}_{2002}/\text{EVA}_{1993})^{1/9} - 1$

= 22,0%

"growth differential" = $g_h - g_i$

= 13,2%

The formula used for the calculation of the historical growth rate in EVA gave the same answer as the geometrical mean return (Keller and Warrack, 2000:100, Bodie, Kane and Marcus, 2003:133). Only companies with positive spreads in 2002 were used for this analysis. The reason for this is that it was expected that higher spreads would be reflected as higher values (and therefore lower "growth differentials"). For companies with negative spreads, this expectation does not arise.

Furthermore, only companies that had positive spreads (and EVAs) for a sufficient number of years (a minimum of five years), so that a credible historical growth rate in EVA could be calculated, were included in the group of companies for this regression analysis. After eliminating some companies according to these criteria, only 30 companies remained (out of the initial 89). The names of the 30 companies, as well as the relevant information for each one, are set out in Table 8.1 overleaf.

Table 8.1: Spreads and sales growth minus the SGR percentages relative to "growth differentials"

No	Company	Year	Spread	Gsales - SGR	5 yr median Gsales-SGR	A Historical EVA growth	B Implied expected future EVA growth	A - B Difference
			%	%	%	%	%	%
1	**SHOPRIT**	2002	38.7	4.9	0.3	30.1	-1.1	31.2
2	**MNET-SS**	2002	28.5	29.8	46.8	29.8	-2.1	32.0
3	**ALTECH**	2002	27.2	-21.5	-3.0	56.5	-2.6	59.0
4	**PICKNPAY**	2002	24.8	13.3	1.4	17.8	4.0	13.8
5	**BOWCALF**	2002	22.7	0.5	0.5	31.3	-9.1	40.4
6	**CMH**	2002	21.9	-9.9	-6.0	35.5	-24.4	59.9
7	**DELTA**	2002	20.7	6.5	-4.9	35.9	1.8	34.1
8	**OCEANA**	2002	20.6	0.7	0.7	23.1	0.0	23.1
9	**CERAMIC**	2002	20.5	0.1	3.5	24.5	5.1	19.4
10	**ITLTILE**	2002	19.8	8.9	-2.1	60.5	3.0	57.5
11	**TIGBRANDS**	2002	16.6	-28.5	-15.9	18.7	0.2	18.6
12	**BEARMAN**	2002	16.4	-10.3	6.4	25.0	-22.9	47.8
13	**UNITRAN**	2002	15.1	1.5	5.0	34.3	-47.9	82.2
14	**CHEMSVE**	2002	14.4	9.5	-15.8	42.6	-1.0	43.6
15	**METCASH**	2002	11.4	86.9	86.9	31.1	1.1	30.0
16	**AHEALTH**	2002	11.3	13.9	14.5	53.0	-5.3	58.3
17	**WBHO**	2002	11.3	8.5	-2.4	27.2	-90.7	118.0
18	**BIDVEST**	2002	11.1	14.7	14.7	55.8	7.7	48.1
19	**REUNERT**	2002	10.3	9.3	-0.4	4.9	8.2	-3.3
20	**SASOL**	2002	10	20.3	20.3	104.0	-6.1	110.1
21	**NUCLICKS**	2002	9.9	6.0	6.0	30.1	-0.1	30.2
22	**MEDCLIN**	2002	9.7	3.2	3.2	42.5	-7.7	50.2
23	**MRPRICE**	2002	8.8	0.8	0.8	38.7	-34.9	73.6
24	**HUDACO**	2002	8	22.4	-10.5	5.1	-8.3	13.4
25	**PPC**	2002	8	27.5	-1.0	21.6	-1.1	22.7
26	**ABI**	2002	7.7	-5.9	-5.9	22.0	8.8	13.1
27	**AFROX**	2002	6.8	9.3	9.3	23.7	2.6	21.1
28	**IMPERIAL**	2002	3.4	16.1	16.1	42.4	-4.5	46.9
29	**NAMPAK**	2002	2.5	26.7	-3.1	-1.1	4.6	-5.7
30	**CAXTON**	2002	1.1	-3.0	-6.8	-0.9	-1.6	0.7

For the purpose of the regression analysis, the 30 companies were divided into two groups of 15 each, namely the top 15 and 16 to 30. With regard to the regression between the spreads and the growth differential, it was anticipated that the top 15 would show a larger negative correlation than the second group of 16 to 30. The regression results showed a correlation coefficient of –0,166 for the top 15 group. For the 16 to 30 group, there was a positive correlation between the spreads and the growth differential, with a correlation coefficient of +0,535. This result was quite different from what was expected (namely a smaller, negative correlation coefficient). Based on these results, one could still assert that higher spreads go with higher value (and lower growth differentials) in the case of the companies with the higher spreads (the top 15). It is hard to explain why there was a positive correlation between spreads and growth differentials for the second group of companies (16 to 30).

As a next step, a regression was done of the sales growth minus the SGR percentage and the growth differentials of each company, again using the two groups indicated above. It was expected that there would be little correlation between these two variables, even if the financial matrix model suggests that sales growth above the SGR percentage would cause cash shortages and that this may have a negative impact on the value of a business.

For the top 15 companies, the correlation coefficient was –0,189, which indicates that the higher the sales growth minus the SGR percentage, the lower the growth differential (and therefore the higher the value). This result is the opposite of what was implied in the financial strategy matrix model. However, a possible reason for this could be that high sales, in spite of their negative impact on cash flows, also lead to higher spreads and in that way also contribute to higher value.

For the 16 to 30 group of companies, the correlation coefficient of the same variables was insignificantly small. This is opposed to the underlying theory of the financial strategy model, but it does strengthen the hypothesis that the difference between sales growth and the SGR percentage for a given year does not play a large part in determining the value of a company.

In order to guard against dismissing the impact of controlled sales growth on the value of the business too easily, it was decided also to do a regression analysis between the growth differential and a five-year median for sales growth minus the SGR percentage. This would show whether the sales growth relative to the SGR percentage does indeed play a role in value determination, if not for a given year, then perhaps over a period of time.

For the top 15 companies, the correlation coefficient was –0,136, which is not very different from the result for the regression of sales growth minus the SGR percentage for a given year. For the 16 to 30 group of companies, the correlation coefficient was +0,487. This result was surprising, because it indicates that higher sales growth minus the SGR percentage goes with higher growth differentials (and lower value). On its own, it supports the financial strategy model, but compared to the same regression for the top 15 group, it does not give a clear signal regarding the impact of sales growth relative to the SGR percentage on the value of a company.

Using the "growth differential" as a measure of value may have some shortcomings, which, under certain circumstances, could provide unreliable results. For instance, if the historical growth in EVA starts off strongly and then tapers off or even becomes negative in later years, the "average" historical growth rate in EVA over the whole period will be low. When this is compared to the "implied expected growth rate", the difference may be small. The low "growth differential" may be wrongly interpreted as "high value". This phenomenon may also account for the significant positive correlation between the spreads and the "growth differentials" of the group of companies with the lower spreads (the 16 to 30 group).

8.2.2 Regression of spreads and sales growth minus the SGR percentage relative to changes in MVA

Finding an appropriate, reliable indicator of value against which the spreads and sales growth minus the SGR percentage can be correlated is not a straightforward exercise. In order to overcome the limitations of using only one measure of value, two other measures were used as well. A regression was done using the (one-year) "change in MVA" instead of the "growth differential" as a measure of value. This time, all the data for the 89 companies for the nine-year period from 1994 to 2002 were used (1993 was the first year and because only changes were taken into account, the 1993 data was discarded). After the data had been sorted according to spreads, only data pertaining to positive spreads were retained. The 499 data observations with positive spreads were divided into two groups, namely the top 250 and the 251 to 499 groups.

In this instance, one would expect that there would be a positive correlation between changes in MVA and spreads and that the correlation would be stronger for the companies with higher spreads. For both the sales growth minus the SGR percentage and the five-year median sales growth minus the SGR percentage, it was expected that there would be a low correlation, and if anything, that it would be negative (indicating that the higher the sales growth is above the SGR, the weaker the cash control and therefore the lower the value).

The results were the following: the correlation coefficient of the regression between the change in MVA and the spreads was –0,3135 for the top 250. This negative correlation is opposite to what was expected. For the 249 to 499 group the correlation coefficient was –0,0552. From this result it is impossible to tell whether spreads influence value positively (the opposite seems to be the case). It is also not possible to infer that the values of companies with higher spreads are influenced more by their spreads than those with lower spreads.

The results of the regression between the changes in MVA and the sales growth minus the SGR percentage as well as that between the changes in MVA and the five-year median sales growth minus the SGR percentage were very low, in fact, almost insignificant, correlations. For the top 250, the correlation coefficient (for the change in MVA and sales growth minus the SGR percentage) was +0,0391 and for the 251 to 499 it was –0,0008, indicating very low levels of correlation and little difference between companies with high spreads and those with low spreads. The correlation coefficient for the regression between the changes in MVA and the five-year median sales growth minus the SGR percentage was +0,0622 for the Top 250 group and –0,0926 for the 251 to 499 group. The results were not very different when the actual sales growth minus the SGR percentage for a given year was used as opposed to when the five-year median was used.

8.2.3 Regression of spreads and sales growth minus the SGR percentage relative to changes in MVA divided by IC

Using the change in MVA, rather than the amount of MVA, eliminated the cumulative effect of the MVA measure. To go one step further, it was decided to divide the change in MVA by the IC at the beginning of the year in order to have a relative measure of value, expressed as a factor. The expectations regarding the regressions between the changes in MVA divided by IC and the spreads (and sales growth minus the SGR percentage) are mainly the same as those for the changes in MVA, as stated in Section 8.2.2. The only difference in the expectations was that there would be a better correlation with spreads this time (better than in the case of changes in MVA).

The results of the regressions were the following: the correlation coefficient for the regression between the changes in MVA divided by IC and the spreads was –0,0408 for the top 250 group. The slightly negative correlation was again contrary to expectation. For the 251 to 499 group, it was –0,1085, which is hardly significant. The difference of the results between the two groups was negligible.

The regression of the change in the MVA divided by the IC and the sales growth minus the SGR percentage showed very little significance. The correlation coefficient was +0,0351 for the top 250 group and +0,0009 for the 251 to 499 group. When the five-year median sales growth minus the SGR percentage was used, the regression results were not very different. For the top 250 group, it was +0,0753 and for the 251 to 499 group it was +0,0132.

The general conclusion drawn from the regressions (done at a 5% significance level) discussed above is that neither spreads nor sales growth minus the SGR percentages had a significant impact on the measures used for value (MVA, changes in MVA and changes in MVA divided by IC) on a year-on-year basis. The implication of this is that the usefulness of the financial strategy matrix as a financial management tool can be questioned, especially if it is used only for the results of one specific year. Further investigation would be required to ascertain whether there are better causal relationships (between spreads and value, for instance) with more statistical significance if values are determined over a longer period, for instance, five or ten years.

8.3 REGRESSION OF MVA AND THE MAIN DRIVERS OF EVA

In this section, the impact of each of the main drivers of EVA on MVA was investigated. MVA and two other variations of MVA, namely MVA divided by the IC at the beginning of the year (MVA/IC_{beg}) and the changes in MVA during the year (Change in MVA) were used for the purposes of the regression. These regression results, as well as the results of regression using EVA and MVA over longer periods than one year, are discussed below.

It must be considered from the outset that MVA is an external measure of value that is affected by a range of different factors. Therefore it was expected that although EVA and its drivers do influence the MVA over time, the effect on a year-on-year basis would not be very significant. The amount of MVA is actually determined by the present value of expected future EVAs, discounted at an appropriate risk-adjusted WACC. Due to the fact that for the calculation of the change in MVA and the growth in EVA no values could be determined for the first year (1993), only the values over the nine-year period (1994 to 2002) were used in respect of all the variables for this regression exercise.

8.3.1 Regression of MVA and EVA and the main drivers of EVA

The values for MVA are determined independently, based on the market values of shares and loans. Theoretically, the MVA of a company can also be determined by calculating the present value of all expected future EVAs, discounted at the WACC. If it is furthermore assumed that the future growth rate in EVA will be constant, the following formula can be used to determine the main drivers of EVA. These drivers of EVA are also the independent variables (x) in the regression analysis, while MVA is the dependent variable (y):

$$MVA = EVA (1 + g_i) / (WACC – g_i)$$

$$MVA = \text{Performance spread} \times IC_{beg} \times (1 + g) / (WACC – g_i)$$

$$MVA = \{(ROIC – WACC) \times IC_{beg} \times (1 + g)\} / (WACC – g_i)$$

$$MVA = [\{EBIT/Sales \times Sales/IC_{beg} \times (1 – t) – WACC\} \times IC_{beg} \times (1 + g)] / (WACC – g)$$

Simple linear regression was done using first EVA as the independent variable and then each of the following independent variables (one at a time, relative to MVA):

- EBIT/Sales;
- Sales/IC_{beg};
- t (the cash tax rate);
- WACC;
- g (the expected future growth in EVA); and
- IC_{beg}.

Note that the historical year-on-year growth in EVA was used as a proxy for the expected future growth rate in EVA.

Sales were included as a further independent variable in order to test their impact on MVA. Variables for which correlation coefficients significant at a 5% level were calculated are indicated by * in the following tables. The full results of the regression (indicated as correlation coefficients, “r”) are set out in Table 8.2 below.

Table 8.2: Regression 1 – MVA relative to EVA and the main drivers of EVA

Variables	All data		EVA pos.		EVA neg.
EVA	0.04493		0.08277		-0.05836
EBIT/Sales	0.02522		0.05517		0.02499
Sales/IC	-0.00095		-0.01650		0.10171
tax rate	*0.10365		*0.09748		*0.09308
WACC	*0.11405		*0.15262		*0.10392
g	0.00141		0.03243		-0.04526
IC_{beg}	*0.22598		*0.53814		0.01224
Sales	*0.41277		*0.58459		*0.31052

* Significant at a 5% level

All the companies in the final database (89) were sorted in terms of spreads and the regression was performed on three groups, namely the results for all years and for all companies, then the results for the years in which companies had positive spreads and then the results for the years in which companies had negative spreads. It was expected that there would be very little correlation between EVA (and its drivers) and MVA for the years in which companies had negative spreads. It is clear that the correlation coefficients were weak, even for the years when companies had positive spreads.

The low level of correlation between EVA and MVA on a year-on-year basis for the period from 1994 to 2002 was disappointing. The correlation coefficient was only 0,083 for the years when companies had positive spreads and 0,045 for all companies and all the years. This result fails to back up claims by Stern (1993:36) of a high correlation between EVA and MVA (an r^2 of 50%) found for a sample of American companies.

As far as the drivers of EVA are concerned, none showed any significant correlation with MVA, except IC_{beg}, with a correlation coefficient of +0,538 (an r^2 of 29%) for the years when companies had positive spreads and +0,226 for all companies and all the years. The second best correlation coefficient was the +0,153 for the WACC, but one would expect this coefficient to be negative due to the notion that higher WACCs should lead to lower MVAs.

To add an additional test, the correlation between sales and MVA was tested and the result of +0,585 (an r^2 of 34%) for the years when companies had positive spreads (and +0,226 for all the companies and all the years) indicates a strong relationship between sales and MVA. The general conclusion about the regression of MVA and the drivers of EVA (as well as EVA itself) is that the linear relationships are weak and not significant, except for IC_{beg}.

8.3.2 Regression of MVA/IC_{beg} and the spreads and the main drivers of EVA

Due to the weak relationship between MVA and the drivers of EVA, it was decided to use other versions of MVA, in this case, MVA/IC_{beg}, to see whether better correlations could be found. Based on the point of view that the drivers of EVA are mostly ratios and percentages (except for IC_{beg}), it makes sense to use a ratio for the dependent variable as well. When MVA is divided by IC_{beg}, the absolute value of MVA becomes a relative value that can be compared for companies of all sizes. In fact, taking the original equation and dividing by IC_{beg} on both sides results in the following variables:

$$\text{MVA} = \text{Performance spread} \times IC_{beg} \times (1 + g) / (\text{WACC} - g_i)$$

$$\text{MVA} = [\{\text{EBIT/Sales} \times \text{Sales}/IC_{beg} \times (1 - t) - \text{WACC}\} \times IC_{beg} \times (1 + g)] / (\text{WACC} - g)$$

If one divides by IC_{beg} on both sides of the equal sign, one gets the following equation:

$$MVA/IC_{beg} = Spread\ (1 + g) / (WACC - g)$$

$$MVA/IC_{beg} = [\{EBIT/Sales \times Sales/IC_{beg} \times (1 - t) - WACC\} \times (1 + g)] / (WACC - g)$$

The last equation shows the independent variables that were used for this regression, namely:

- EBIT/Sales
- Sales/IC_{beg}
- t (the cash tax rate)
- WACC
- g

The correlation results are set out in Table 8.3.

Table 8.3: Regression 2 – MVA/IC_{beg} relative to the spreads and the drivers of EVA

Variables	**All data**		**EVA pos.**		**EVA neg.**
Spread	0.00662		-0.02707		0.01424
EBIT/Sales	0.01103		0.01141		0.12100
Sales/IC	*0.98488		*0.98768		*0.29649
tax rate	0.03285		0.03074		0.07533
WACC	-0.04597		-0.08085		*0.30107
g	0.00303		0.00282		-0.01915

* Significant at a 5% level

This regression provided a surprising result. The relationship between spreads and MVA/IC_{beg} was almost non-existent, with a correlation coefficient of –0,027 for the years when companies had positive spreads and +0,007 for all companies and all the years. The correlation coefficient of the relationship between Sales/IC and MVA/IC_{beg} was a remarkable +0,988 (an r^2 of 98%) for the years when companies had positive spreads and +0,985 for all companies and all years. This extremely high level of correlation could be due to the fact that both the dependent variable and the independent variable had been divided by the amount of IC at the beginning of the year.

It is also interesting to note that the correlation is not nearly as high for the years when companies had negative spreads (an r of +0,296). The only other correlation coefficient worth mentioning is the –0,081 (for the years when companies had positive spreads) for the WACC. This level of correlation is not really significant, but at least the negative sign indicates that value is affected adversely when the WACC goes up (as it should be).

8.3.3 Regression of change in MVA and EVA and the main drivers of EVA

The last variable used to represent value in the regression analysis was the change in MVA for any given year. This adjustment overcame the problem that arises from the fact that MVA is a cumulative measure, calculated from the inception of a company, while EVA is an annual amount. It has been recognized that changes in MVA over the period of one year would be volatile due to many impacting factors and that the relationships between the changes in MVA and the internal drivers of value and are not expected to be strong.

The same dependent variables that were used for regression 1 (using MVA as the dependent variable) were employed for this regression. The results are set out in Table 8.4 overleaf.

Table 8.4: Regression 3 – Change in MVA relative to EVA and the main drivers of EVA

Variables	All data		EVA pos.		EVA neg.
EVA	-0.12433		-0.29789		-0.04152
EBIT/Sales	0.01012		-0.10277		0.01516
Sales/IC	0.00231		0.00370		0.03129
tax rate	0.05220		0.08199		0.04945
WACC	0.05420		0.06310		0.05407
g	0.01079		0.08913		-0.05459
IC_{beg}	0.04881		0.07455		0.04230
Sales	*0.10053		*0.18160		0.08412

* Significant at a 5% level

The results of this regression were, as in the case of regression 1, disappointing. The correlation coefficient for the change in the MVA regressed against the EVA was negative (-0,298 for the years when companies had positive spreads and – 0,124 for all companies and all years). For none of the independent variables tested was the correlation coefficient higher than +0,100, indicating very weak relationships. The correlation coefficient for sales and changes in MVA was +0,182 for the years when companies had positive spreads and +0,101 for all companies and all years.

Apart from Regression 2, which showed very high correlation between sales/IC_{beg} and MVA/IC_{beg}, the relationships between all the independent variables tested and the dependent variable representing value proved to be weak. It must be borne in mind that these regressions were done on a year-on-year basis. This raised the question whether there would be better correlations if regressions were done over longer periods. The results of such regressions are described in the next section.

8.3.4 Regression over periods longer than one year

Considering that the results of the year-on-year regression of MVA and EVA, as well as MVA and the main drivers of EVA showed weak relationships in general, it was decided to test the relationship between changes in MVA and the sum of EVA over longer periods. Because the required data was only available for nine full years, two four-year periods, namely the first from 1994 to 1997 and the second from 1999 to 2002, were chosen.

The idea was also to test whether EVA lagged behind MVA (in other words, whether current EVA only affects future MVA), or whether MVA lagged behind EVA (in other words, whether current MVA reflects future EVA). It was expected that the latter view (MVA lagging EVA) was more likely to show significant relationships.

Added to the two four-year periods, regression was also done for the full nine-year period from 1994 to 2002, as well as for the seven years from 1995 to 2002. The results of these regressions are set out in Table 8.5 overleaf.

Table 8.5: Regression of MVA relative to EVA over periods longer than one year

Regression 4 (Change MVA 1994 to 1997 and total EVA 1994 to 1997)						
		All data		**EVA pos.**		**EVA neg.**
		*0.24818		*0.44999		0.06827
Regression 5 (Change MVA 1994 to 1997 and total EVA 1999 to 2002)						
		*0.22982		*0.26964		-0.56740
Regression 6 (Change MVA 1999 to 2002 and total EVA 1994 to 1997)						
		-0.02365		-0.43423		*0.10579
Regression 7 (Change MVA 1999 to 2002 and total EVA 1999 to 2002)						
		-0.03535		0.06831		-0.27433
Regression 8 (Change MVA 1994 to 2002 and total EVA 1994 to 2002)						
		0.07840		*0.23477		0.08564
Regression 9 (Change MVA 1995 - 2001 and total EVA 1995 - 2001)						
		*0.16750		*0.41319		*0.16171

* Significant at a 5% level

The results of the regression of changes in MVA and the sum of the EVA over the four years from 1994 to 1997 (Regression 4) revealed a correlation coefficient of +0,450 (an r^2 of 0,203) for companies that had positive EVAs in 2002 and +0,248 for all companies for all the years. This relationship can be considered as reasonably significant, indicating that about 20% of the change in MVA can be explained by looking at changes in the sum of EVAs for the period from 1994 to 1997 (of companies with positive EVAs in 2002).

The next regression (Regression 5) was done by comparing the change in MVA for the period from 1994 to 1997 with the sum of the EVAs for the period from 1999 to 2002. This result, compared to that of Regression 4, would show whether changes in MVA reflect EVAs for the same period better or EVAs for a future period. The correlation coefficient for companies with positive EVAs in 2002 was +0,270 and +0,230 for all companies for all the years. It can therefore be inferred that, at least for the periods involved, changes in MVA reflect changes in the sum of EVAs for the same period better than for a future period.

Regression 6 was done using the change in MVA for the period from 1999 to 2002 compared to the sum of the EVAs for the period from 1994 to 1997. The correlation coefficient of –0,434 for the companies with positive spreads in 2002 (and –0,024 for all companies and all years) indicates a negative relationship, which leads one to conclude that current EVA does not drive future MVA.

If one applies this analysis to the second four-year period, from 1999 to 2002 (Regression 7), the correlation coefficient for the companies that had positive spreads in 2002 was +0,068 (and –0,035 for all companies and all the years). This shows a much weaker relationship than for the period from 1994 to 1997.

If the full nine-year period from 1994 to 2002 is examined (Regression 8), the correlation coefficient is +0,235 for the companies that had positive spreads in 2002 and +0,078 for all companies and all the years. This indicates that increasing the length of the period does not lead to an improvement in the strength of the relationship between the sum of the EVAs and the change in MVA.

In order to test the relationships over a relatively stable economic period, it was decided to eliminate the years in which specific events were known to have had a large impact on economies and share prices, namely 1994 and 2002. The data for 1994 were eliminated because of the dramatic impact that the first democratic election in South Africa had on local share prices. The aftermath of the Twin

Towers disaster in New York during September 2001 had a huge impact on share prices worldwide (the most dramatic effect on share prices took place in 2002) and for this reason it was decided to eliminate 2002 as well.

Regression 9 shows the results of the correlation between the sum of EVAs and changes in MVA over the seven-year period from 1995 to 2001. The correlation coefficient for companies with positive spreads in 2002 was +0,413 (an r^2 of 0,17) and +0,166 for all companies and all the years. These results show a much stronger relationship than the nine-year period from 1994 to 2002, but the magnitude is still not close to that reported by Stern (1993:36).

8.3.5 Regression using natural logarithms

Theoretically the nature of the relationship between MVA and the main drivers of EVA is multiplicative, rather than additive. Therefore taking natural logarithms of MVA and the main drivers of EVA would transform the equation into a linear model, which would hopefully show better linear correlation results. Unfortunately the data did not allow the completion of this exercise because there were numerous negative values for EVA and MVA, making the calculation of the natural logarithms impossible. Ignoring the negative values would lead to the elimination of so much data that the results would not have been reliable.

8.3.6 Regression of median values for the period from 1993 to 2002

In an effort to determine whether better correlations can be found if short-term fluctuations are eliminated, it was decided to test the relationships between MVA, EVA and the main drivers of EVA by using the ten-year median for each variable. The results of these regressions set out in Table 8.6 overleaf.

Table 8.6: Regression of median values for MVA, EVA and the drivers of EVA for the period from 1993 to 2002

Variable	All data		EVA pos.		EVA neg.
EVA	*0.59372		*0.86861		*0.57239
EBIT/Sales	0.09536		0.00706		*0.48060
Sales/IC	0.08596		-0.01656		*0.36125
tax rate	*0.22314		0.07018		*0.49583
WACC	*0.14057		*0.20900		*0.14057
g	0.03231		-0.01451		0.05839
ICbeg	*0.34775		*0.88023		-0.02426

* Significant at a 5% level

The results indicate a strong relationship between the median MVAs and the median EVAs with a correlation coefficient of +0,869 (an r^2 of 75%) for companies with positive median EVAs and +0,594 for all companies. Only one of the main drivers of EVA showed a strong correlation that makes economic sense with MVA. This variable was the median IC_{beg} with a correlation coefficient of +0,880 (an r^2 of 77%) for companies with positive median EVAs and +0,348 for all companies.

8.3.7 Stepwise multiple linear regression

In order to determine the nature of the relationship between shareholder value and the main drivers of EVA, taken together in one multiple regression equation, the stepwise multiple regression approach was used. The first stepwise regression was done between MVA and the main drivers of EVA and the second between MVA/IC and the main drivers of EVA. The backward selection stepwise regression approach was used by eliminating terms (variables) not significant at a 5% level.

The results of the final step in the stepwise regression between MVA and the main drivers of EVA are presented in Table 8.7 and the results of the final step of the stepwise regression between MVA/IC and the main drivers of EVA are shown in Table 8.8.

Table 8.7: Final step of stepwise regression between MVA and the main drivers of EVA

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.250131759
R Square	0.062565897
Adjusted R Square	0.060216438
Standard Error	6536.601298
Observations	801

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	2275641306	1137820653	26.62991749	6.37322E-12
Residual	798	34096270912	42727156.53		
Total	800	36371912219			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-221.671719	386.2102862	-0.573966378	0.566152289	-979.7792137	536.4357757	-979.7792137	536.4357757
t	5802.071811	1854.640752	3.128407377	0.001821429	2161.523891	9442.619732	2161.523891	9442.619732
ICbeg	0.314318869	0.047324009	6.641847857	5.72822E-11	0.221424694	0.407213045	0.221424694	0.407213045

Table 8.8: Final step of stepwise regression between MVA/IC and the main drivers of EVA

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.985258265
R Square	0.970733848
Adjusted R Square	0.970623687
Standard Error	3.64005123
Observations	801

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	350273.9671	116757.989	8811.941685	0
Residual	797	10560.22845	13.24997296		
Total	800	360834.1956			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-4.576905523	0.741764063	-6.170298285	1.08381E-09	-6.032947006	-3.12086404	-6.032947006	-3.12086404
Sales/ICbeg	0.908694655	0.005595745	162.3902975	0	0.89771052	0.91967879	0.89771052	0.91967879
WACC	15.85588954	4.92548117	3.219155447	0.001337735	6.187444719	25.52433435	6.187444719	25.52433435
ICbeg	7.20065E-05	2.65966E-05	2.707354328	0.006927407	1.97988E-05	0.000124214	1.97988E-05	0.000124214

The final results of the stepwise regression between MVA and the main drivers of EVA shown in Table 8.7 indicate a low overall correlation of the independent variables (drivers of EVA) relative to MVA, with an r^2 of 0,063. The only two independent variables that remained in the model because they make significant contributions to the determination of the value of MVA were the taxation percentage and IC. The result does not add any new information that would be helpful in managing the drivers of EVA.

The results of the stepwise regression between MVA/IC and the main drivers of EVA shown in Table 8.8 indicated extremely high correlation of the independent variables relative to MVA/IC, with an r^2 of 0,971. The high correlation was mainly due to the variable sales/IC. Again this result does not add any new information, as the single regression between MVA/IC and sales/IC already indicated this extremely high positive correlation, which appears to be artificial because both the dependent and independent variables are divided by IC.

8.4 CONCLUSION

The aim of this chapter was, first, to describe the statistical tests used to verify the strength of the financial strategy matrix and to report on the results. Second, the strength of the relationship between MVA and EVA, and the main drivers of EVA were tested, using different versions of MVA.

For the first series of tests, the impact of spreads and sales growth minus the SGR percentage on three different measures of value were tested. The measures used to represent value were the “growth differentials”, changes in MVA and MVA/IC_{beg}. For these tests, only companies with positive spreads (and EVAs) were used, because no relationships were expected between the spreads (and sales growth minus the SGR percentage) and the market value of companies with negative spreads.

As far as the impact of spreads on the three measures of value is concerned, there were some results that indicated a positive relationship. However, when the group of companies with high spreads was compared to the group with low spreads, it was not possible to tell whether higher spreads had a bigger impact on value than lower spreads.

The relationship between sales growth minus the SGR percentage and the three measures of value proved to be very weak and almost non-existent. The reason for this may be that high sales growth may give two different signals. The one is that the high sales growth may indicate bad cash management and lead to a build-up of cash shortages (as highlighted by the financial strategy matrix). High sales growth may also be regarded as a driver for higher profits and in that way contribute to higher value. Based on this outcome, one can conclude that the sales growth minus the SGR percentage does not have a significant impact on value at all.

The relationship between MVA and EVA, as well as the main drivers of EVA, was also tested. Two other versions of MVA, namely MVA/IC_{beg} and change in MVA, were used to check whether better correlations could be found than with MVA. The data of the 89 companies were sorted according to spreads and the correlation coefficients were determined for three groups, namely positive spreads, negative spreads and all companies.

None of the relationships between EVA and the three measures for value were significant on a year-on-year basis. A slightly better correlation was found when the period was extended to four years. However, the strength of the relationship still falls far short of that reported by Finegan (1991:36) with an r^2 of 61% for MVA relative to EVA, by Stern (1993:36) with an r^2 of 50%, by Uyemura *et al.* (1996:98) with an r^2 of 40% and by Grant (1997:39) with an r^2 of 32% for different samples of American companies.

It must be noted that the American results were obtained only for companies with positive EVAs and after some averaging and clustering of data had been done. When ten-year medians are used in the regression done on the South African companies, a very strong relationship between MVA and EVA is found (an r^2 of 75%). This indicates that 75% of the changes in the (ten-year) median MVAs can be accounted for by the changes in the median EVAs. The high level of correlation is mainly due to a very significant relationship between MVA and IC_{beg}, which is a component of EVA.

The relationships found in this study between the main drivers of EVA and the measures of value on a year-on-year basis were generally not significant, but there were two exceptions. A correlation coefficient of +0,538 (an r^2 of 29%) indicated that there is a strong relationship between IC_{beg} and MVA. Furthermore, excellent correlation was found between sales/IC_{beg} and MVA/IC_{beg} (an r^2 of 98%). It indicates that asset turnover has a large impact on the relative measure of value of a company. This result must, however, be used with caution as it could be that the abnormally high correlation was caused by the fact that both dependent and independent variables were divided by IC_{beg}.

The general conclusion from the statistical tests is that the results were not significant and conclusive enough to say that the two criteria plotted on the financial strategy matrix model have a significant effect on shareholder value on a single year basis. It also did not provide answers clear enough to identify the strongest drivers of value that have a significant impact on an externally determined measure of value, like MVA, if the data is compared on a year-on-year basis. The only exceptions were IC_{beg} in the determination of MVA and a statistically very strong relationship between sales/IC_{beg} and MVA/IC_{beg}.

The analysis also showed that there is a very strong relationship between the median MVA and the median EVA of companies with positive spreads for the period from 1993 to 2002.

The next chapter discusses the final conclusions and recommendations.