



INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT

VOL. 2, NO. 1, 2009

PAN-AFRICAN BOOK COMPANY

INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT

Volume 2, Number 1, 2009

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This journal is an academic journal published quarterly. Subscription rate for individuals is US\$25 per issue (Foreign Price) and ø25 (Domestic). Per annum cost is US\$100 (Foreign) and ø100 (Domestic).

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Published by Pan-African Book Company in association with Minkah-Premo Co., No 3, Emmause, 2nd Close, Labone, P.O.Box 1495, Accra, Ghana

First Published 2008

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International Journal of Pure and Applied Science is a quarterly Journal Published by the Pan-African Journal Series. Papers for Publication should be sent to our *E-mail: centrejournal@yahoo.com*: *If you have additional question, please feel free to contact us at the addresses below: The Managing Editor, Centre Journals, Minkah-Premo Co., No 3 Emmause, 2nd Close, Labone, P.O.Box 1495, Accra, Ghana. E-mail: centrejournal@yahoo.com*

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MEASURING CHANGES IN FINANCIAL HEALTH THROUGH RATIO ANALYSIS

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ABSTRACT

The paper presents a critical examination of the performance of the traditional ratios, followed by a description of the development and testing of a model which measures changes in the financial health of the companies. With the number of liquidations increasing, it is important to try to establish some method of measuring changes that takes place in the financial health of companies. Certainly, over the term, the success of share investment in companies depends to a large extent on organization investments, which is return on investments. However, lenders, bankers, creditors and employees, must also be interested in the above factors for the health of the company in its ability to meet its obligations which is determined in part by how profitable it is and how well it is managed. Generally speaking, measures of liquidity involve comparisons of a company's relatively immediate liabilities with those assets available to meet them. The ratio is measured to assess the cover available to meet the existing current liabilities these being assumed to require repayment in the relatively near future. It is obvious that all such ratios are liable to window-dressing and valuation problem which could distort them and lead to misleading portrayal of liquidity. Findings show that 35% of tested companies revealed the key ratio producing a 20% return or more in the second year from failure when using profit/net operating assets while only 2% of companies showed a 20% or more return when using total asset. The model gave indications on early warnings and identifications of ratio score movements. Amongst others, it was recommended that the audit functions and the propriety of model can alleviate many of ratio-related potential problems, but the analysis must understand the trailities of the data and, particularly, the problems of comparison over time and between companies. Further, the use of total assets is strongly recommended as the key profitability ratio gives misleading results to failing companies when net operating assets are used as the denominator.

INTRODUCTION

With the number of liquidations increasing, it is important to try to establish some method of measuring changes that take place in the financial health of companies. This paper seeks to:

- a) Examine the traditional ratios and show that the profitability ratios can be misleading, while the liquidity ratios are not responsive to changes taking place in the working capital cycle of failing companies.
- b) Explain the construction of a model which consists of five ratios which, when evaluated, can be combined to produce a single score.
- c) Provide a worked example and offer suggestions for interpretation using data from a failed company.
- d) Show how the model has been tested on two groups:
 - i. A failed group comprising of 48 quoted companies that have not gone the liquidation way since 1978.
 - ii. An on-going group, of similar number, but in good health.

TRADITIONAL RATIOS

Before presenting a model which can be used to measure changes in the financial health of companies, it is good to describe some important findings concerning the performance of the main traditional ratios when applied to failing companies. These are the ratios that are widely taught, examined and used by those wanting to analyze financial statements. The key profitability ratio gives misleading results to failing companies when net operating assets are used as the denominator; thus, the use of total assets is strongly recommended. The liquidity ratios are difficult to interpret and slow to respond to changes in the working capital cycle. The two liquidity ratios used in the model are suggested as alternatives for long-term and immediate solvency; also suggested is the simple net working capital/current liabilities ratio.

Measuring Changes in Financial Health through Ratio Analysis

PROFITABILITY

For many years there has been general uncertainty regarding the components to be used when calculating return on investment. The main problem is agreeing a definition for capital employed. The most popular definition in the United Kingdom (UK) is net operating assets which consists of total assets less current liabilities. This was the definition suggested by a study group in 1955 and reported in *Accountancy* in July 1956. The American definition is simply total assets and is justified by Horgren (1970) when he states: 'the measurement of operating performance (i.e. how profitability assets are employed) should not be influenced by the management's financial decisions (i.e. how assets are obtained). Operating performance is best measured by the rate of return on total assets'. The paper evaluates both methods using data constructed from the accounts of a failed company and show that the ratios produced by the first method can be misleading.

Table 1

COMPANY 'A'				
	2003	2004	2005	2006
Sales	39,400	38,900	43,200	42,000
Profit + tax + interest	5,000	3,600	2,700	700
Fixed assets	10,100	11,600	13,000	13,500
Current asset	21,300	23,300	27,700	31,000
Current liabilities	11,800	15,900	22,200	34,300
Net operating assets	19,600	19,000	18,500	10,200
Total asset	31,400	34,900	40,700	44,500

Table 2

COMPANY 'B'				
	2003	2004	2005	2006
Profit/net operating asset	25.5	18.9	14.6	6.9
Profit/sales	12.7	9.3	6.3	1.7
Sales/net operating assets	2.01	2.05	2.34	4.12
Profit/total assets	15.9	10.3	6.6	1.6
Sales/total assets	1.25	1.11	1.06	0.94

Both methods show the key ratio falling but profit/total assets shows a faster decline. Since the profit margins are the same for each method, the difference is due to the sales generated from the capital base. As the sales are the same for each method, the difference is due to the capital base. A look at the figures in Table 1 shows the net operating assets falling in the final year due to increases in short-term borrowing, while the total assets rises steadily throughout the period. In the first method, the sales generated from net operating assets are seen to increase from 2.01: to 4.12: 1 over the four years. This method mixes profitability with sources of finance and favours a policy of short-term. This would reduce net operating assets and increase the sales generated from the first method: it is clear that this method shows the sales generated from the asset base, and is not affected by the method or source of finance. Bliss (1924) commented: 'this ratio is a sounder measure of power of the operations, because it is based on the net results realized from operations, and the full amount of capital used. Therefore, it is clearly a measure of operating earning power.' The main aim of the key ratio must be to measure the profitability of a company and then use it to compare, against previous/future years. It is also important to accept that other ratios can be used to measure the financial standing of a company (Internet Center for Management and Business Administration, Inc., 2007; Institute of Chartered Accountants, England and Wales, 2008). While the first method will not produce such dramatic results for the majority of companies, it does give misleading information on profitability to those companies that are most at risk; namely those in difficult trading circumstances who make substantial changes in short-term finance in order to keep things going.

LIQUIDITY

The working capital position, that is, the relation between current asset and current liabilities of the business, is the point generally noted first in reading a balance sheet. It is probably more commonly understood than any other ratio or relationship to be read out of a balance sheet. This is how Bliss (1924) described the

current ratio which has been used since the turn of the century. While the current ratio continues to enjoy widespread support, it is certainly not without its critics, who tend to highlight at least two main problems. The first problem is what to measure the ratio against. A ratio of 2:1 has long been considered satisfactory but an interesting analysis reported by Kirkman (1973) using data taken from the Annual Abstract of Statistical for 1972 shows the current ratio falling from 2.11 : 1 down to 1.53 : 1 during 1960s. The other problem is stated by Wright (1956) in a detailed examination of the working capital ratio, when he states: 'it would appear, therefore, that the interpretation of the working capital ratio may indicate overstocking, poor credit control, loss of sales or repayment of overdraft: a decrease may reflect better stock and credit management, greater use of bank finance or overtrading and non repayment of creditors.' This view has been stated in more general terms by Paton (1928) in his article on the limitations of financial and operating ratios and Horngren (1970), who concludes: 'An increase in the current ratio does not necessarily mean that the business is currently doing well, or vice versa. In other words, changes in current ratios are difficult to interpret.' This difficulty can be confirmed by the examining the current ratio for a failed company for the five years before failure.

	5	4	3	2	1
Current ratio	1.71	1.81	1.47	1.25	0.90

Taking the ratio year on year, how would the decline be interpreted? From the third to the second year, the ratio drops from 1.47 to 1.25; this is a fall of only 15 percent. This does not indicate any serious deterioration in the ratio, yet a closer examination would reveal that the current ratio of 1.47 is made up of 1 representing a further 47 percent down to 25 percent from the third to the second year. This is the basis of the net working capital/current liabilities ratio and is suggested as an alternative to the current ratio. 'When credit men began to question the complete efficacy of the current ratio as a credit guide, a second, simple, supplemental comparison came into existence: the sum of cash and receivables with the current debt. If the current ratio was "two for one" or better and the cash and receivables equaled or exceeded the current liabilities, an account was said to give double assurance of credit stability.' This is how Foluke (1933) describes the liquid ratio or 'acid test'. Liquid assets covering current liabilities has long continued to be rule-of-thumb, although an analysis of the accounts of companies in retailing will often show a ratio of 0.5:1 or less; a higher ratio indicating idle resources. Kirkman (1973), in the analysis already described, shows the liquid ratio falling from 1.08:1 down to 0.88: 1 during the 1960s." The liquid ratio is a measure of a company's ability to pay off its current liabilities without having to liquidate stock. The problem with this ratio is that it is slow to respond when substantial changes are made to the financing of a company, the main reason being that debtors form the largest element of liquid assets and most companies tend to exercise good credit control. This produces a 'nice' steady ratio. Using data from the same failed company, the liquid ratio for the five years before failure was:

	5	4	3	2	1
Liquid ratio	0.65	0.76	0.53	0.51	0.34

It is not until the final year that the ratio responds by a drop of 35 percent. This was mainly due to sharp increase in short-term borrowings.

CONSTRUCTION OF THE MODEL

The main aim in developing a model is to produce a set of ratios that are simple to evaluate, can be used to help measure changes in the financial health of companies and will result in action being taken to restore any imbalance.

In order to explain the development of the model, the following points will be discussed:

1. Key elements in failing companies
2. Selection criteria for ratios
3. Choosing the ratios
4. A worked example.

Measuring Changes in Financial Health through Ratio Analysis

KEY ELEMENTS IN FAILING COMPANIES

In the early analysis, while working with five years of data for each company, it became clear that a number of companies were at subsistence level for all five years before failure. This is in line with Argenti's findings when he states 'even quite small companies take years to fail and large ones may take a decade.' It is clear from the above that there is much to be gained from being able to identify such changes in time to take suitable action. What then are the main elements that cause changes in the financial health of companies? There appear to be four distinct phrases that a failing company follows:

Trading stability

Most failing companies experience a fall in sales generated from an asset base. This is true of the declining product cycle and the rapid expansion company. The latter indulging in continuous overtrading.

Declining profits

The conditions encountered in trading stability will alone erode a company's profit margins and when combined with other uncontrolled costs can result in substantial losses.

Declining working capital

If not checked, declining profits will lead to a decline in working capital, accelerating if the company turns into a loss situation. Further reductions in working capital will be caused by continued expansion of fixed assets.

Increase in borrowings

Instead of tackling the problem of trading stability and profitability, the failing company increases borrowings to maintain a level of working capital. This has a double effect:

- i. It further reduces profit through additional interest payments;
- ii. Increases the gearing of a company at a time when it is not advisable to do so.

SELECTION CRITERIA

The selection of ratios to be included is the most important factor in the development of a predictive model. It is not simply a matter of ranking the ratios in order of predictive power. Each ratio selected must reflect the elements that cause changes to company's financial health. Chen and Shimerda (1981) concluded that "the popular procedure of selecting the ratio with the highest absolute predictive power makes the selection sensitive to the sample. Such a procedure may be satisfactory for data reduction purposes but it is certainly not satisfactory for model building or theory testing. Concerted effort should be applied to the process of selecting the most representative ratios." While Blum (1974) states in suggestions for further research "that one fruitful avenue for further exploration is the 'use of ratios different from those of traditional analysis. For example, 'if' interaction variable, which might discriminate better than either of its two multiplicands. A common example of Blum's idea would be the net working capital ratio:

$$\frac{(\text{Current assets} - \text{Current liabilities})}{\text{Current liabilities}}$$

If the net working capital halves, then this ratio will halve while the popular current ratio would only record a drop of say 1.50:1 to 1.25:1. The following points were taken into account during this process: Must be simple to calculate: The ratios used must have a clear meaning which can be applied consistently by any user. Ratio responsive to change year on year: It is necessary that the ratios selected are responsive to changes taking place within a company and will deteriorate for companies that are failing but remain constant or increase for on-going companies. In certain circumstances ratios might not deteriorate should a company take action to prevent a decline. For example, if a company raises additional funds from shareholders, this will improve the gearing and working capital ratios and will prolong the life of the company or, if a company manages to maintain a given level of sales, this will improve a measure of trading stability.

CHOOSING THE RATIOS

Financial data, for a five year period was collected for eight companies that had gone into liquidation. A computer program was then used to generate simple ratios. It compared every piece of data with a chosen denominator. Over 500 combinations were tested during this time. This activity quickly showed up the ratios that deteriorated and those that did not. It was also useful to get the feel of data; It was observed for example, that stocks fell in the final year, that short-term borrowings increased and that current debt tends to increase faster than current assets or total assets. The ratios used were also tested, also tested the ratios used in other models but only found agreement with the profit/total assets ratio, although have preferred the profit before tax definition for profit. There then followed a period of intense concentration when experimented and tested various combinations of data to produce ratios that then measured the important changes that can take place in the financial health of companies. During this time increased the number of failed companies to 48. The ratios finally selected were:

(Sales - total assets)/sales

A measure of trading stability. It highlights the important relationship between assets and sales. When a company increases its assets base, it is looking for a corresponding increase in sales. Companies experiencing trading difficulties are unable to maintain a given level for this ratio. Deterioration indicates a fall in the sales generated from the asset base. If the ratio is maintained, it can produce a stabilizing effect even for a company that is failing.

Profit before tax/total asset

Profit is taken after interest expense but before tax because failing company borrow more and suffer increases in interest in the years to failure. Total assets exclude intangibles and are used as the base because they are not influenced by financing policies and tend to remain constant or increase. Failing companies tend to show a decline in profits in the years to failure; often turns into a loss. The deterioration in profit is sufficient to cause this ratio to fall. However many companies are involved in rapid expansion and this, if present, will cause the ratio to fall even faster. Capital employed was not used as the base since it includes current liabilities which normally increase in the years to failure; this causes Capital employed to drop.

(Current assets – total debt)/current liabilities

An extension of the working capital also to deduct long-term debt from current assets. Measures a company's ability to repay its debt without selling fixed assets. Total debt is taken in preference to the usual current liabilities because, when a company is in difficulty, it does not matter whether the debt is long or short – only the overall amount of the debt. When compared over a number of year, failing companies show a marked deterioration in this ratio due to current assets remaining constant while total debt increases.

(Equity – total borrowings)/ total debt

A gearing ratio. A low ratio indicates a high proportion of debt which means high gearing with associated high risk. Failing companies experience a drop in equity through a combination of losses in operations and reorganization costs while at the same time borrowing tends to increase. This can turn a healthy balance in favour of equity into a negative balance where borrowings exceed equity. Should a company not borrow but instead obtain additional funds from shareholder, then this will have a stabilizing effect and reduce the risk of moving towards high gearing and associated interest expense.

(Liquid assets – short-term borrowings)/creditors

This test changes in immediate liquidity. After deducting short-term borrowings from liquid assets, it is then possible to measure the immediate cover for creditors. Since the failing company intends to increase the level of short-term borrowings in the years of failure; this results in a continued reduction maintain liquidity during a period of loss making.

A worked example

In order to explain the further development of the model it will be useful to follow through a worked example. To do this, basic data for 2000 for the same company used in the traditional analysis was extracted, since it follows a similar profile of the total failed group and is therefore considered to be representative.

Measuring Changes in Financial Health through Ratio Analysis

Table 3

Company "C"	
2003	
Sales	39,400
Profit before tax	4,000
Fixed assets	10,100
Current assets	23,100
Stock	10,900
Current liabilities	10,300
Creditors	6,400
Bank overdraft	3,400
Equity	8,500
Long-term loans	2,200

In table 4, certain data have been combined to ease the transition from the basic data in Table 3 to the analysis that follows.

Table 4

Company "D"	
2003	
Liquid assets	9,000
Total assets	31,400
Total debts	13,300
Total borrowings	3,900
Sales – total assets	8,000
Current assets – total debt	8,000
Equity – total borrowings	12,100
Liquid assets – Bank overdraft	6,600

The ratios are then computed and the individual scores added to produce a total score, this is shown in columns 1 and 2, of Table 5, the total score being 2.72. It is at this stage that one must question the validity of adding the individual scores together. They are simply not comparable: furthermore, it could be useful to increase the effect of one ratio and perhaps reduce the effect of another. In column 3 of table 5, each individual score is stated as a percentage of the total score. The most noticeable feature is that profit/total assets accounts for only 5 percent of the total score. It can also be appreciated that this ratio could, at best, only attain a maximum individual score of say. 0.30, while the third ratio, a liquidity ratio, could easily achieve a score of over 1. The last two columns in table 5 show the raw score in column 2 being multiplied by weights (or factors) to produce an adjusted score. The weights have been chosen, based on a balance between comparability and importance for the total failed group. The effect of using the weights reduces the score from 2.72 to 1.37. The main purpose of this section has been to show the calculation of the individual ratios and the reasoning behind using weights to adjust each individual score. In practice, it would not be necessary to go through this procedure: each ratio would be calculated and multiplied by its weight in one operation.

Table 5

	1	2	3	4	5
	<i>Basic data</i>	<i>Raw score</i>	<i>%</i>	<i>Weights</i>	<i>Adjusted score</i>
<u>(Sales – total assets)</u>	8,000	0.20	7	3.0	0.60
Sales	39,400				
<u>Profit before tax</u>	4,00	0.13	5	3.0	0.39
Total assets	31,400				
<u>(Current assets – total debt)</u>	8,000	0.68	25	0.6	0.41
Current liabilities	11,800				
<u>(Equity – total borrowings)</u>	12,100	0.91	34	0.3	0.27
Total debts	13,330				
<u>(Liquid assets – bank overdraft)</u>	6,600	0.80	27	0.3	0.24
Creditors	8,200				
		<u>2.72</u>			<u>1.37</u>

INTERPRETATION OF THE SCORE

In traditional ratio analysis, the same ratios are used across 'industry with ratio values being interpreted by observing the movements from previous periods or from an industry average. Since the model has been developed for use across 'industries', it is appropriate to use similar interpretation, i.e. observing the movements in the score. In testing the models it has been found that, should the score fall by approximately 40 percent or more in any year, then substantial changes have taken place in the financial health of a company. Immediate steps should be taken to identify the reasons for the change and all necessary steps taken to stop the decline and restore the balance. If the score falls by approximately 40 percent or more for a second year running, it is unlikely that the company will survive, unless drastic changes are made to stop the decline. There was a fall of 47 percent. There is no single reason for the decline; all the ratios have shown a solvency – it is steady so the liquidity seems reasonable. An increase in gearing but still at an acceptable level – it was at that level three years previously. It is clear from the above that there are major shortcomings in the performance of the traditional ratios, since they give no indication of the substantial changes taking place in the financial health of the company. On the other hand the model does give early warning, in the movement of the total score, and then assists in identifying the reasons by providing an analysis of movement of the total score and then assists in identifying the reasons by providing an analysis of movements in the individual ratio scores. Using the model, the first warning was given three years before failure when the score dropped from 1.37 to 0.72 and if budgeting system had been in operation the movement could have been identified up to a year earlier.

Testing

So far have used the same failed company to help examine the traditional ratios, then to explain the development and interpretation of the model. In order to check the validity of the findings it is necessary to extend the analysis to a wider group of failed companies. Further data were obtained when a list of companies going into liquidation between 1988 and 1998 was prepared from a search through the Stock Exchange Year Book for 1980/1981; this list was increased using the Stock Exchange Fact Book, Table B2, 'Cancellations, Suspensions and Restorations', for each quarter in 1981 and 1982.

Each company was then checked against the Analysis Service of Extel Statistical Services Ltd.

- a) To confirm the date of liquidation;
- b) To extract data for ten years.

During this process the following companies were excluded:

- i. Financial institutions;
- ii. Property companies;
- iii. Investment trusts

Companies were not excluded because of size or industry type other than the above. This activity produced a total of 4,000 companies. The data were then analyzed to produce a number of statements covering the traditional ratios and the model, to show the effect for each company for a 10 year period. It was discovered that it was not possible to combine the results and produce a meaningful grand average. To do this would be to ignore completely the individuality of each company and its unique ability to take certain corrective action at different times during the final five years. For example, a number of companies go to their shareholders for additional funds; this in turn provided a temporary improvement in the liquidity and gearing ratios and will cause their score to increase in that year. The main point is that companies choose different times to take this action. It would therefore seem appropriate to test the validity of the findings by examining the ability of the traditional ratios and the model to provide an indication when significant changes were taking place in the financial health of the companies

Profitability

Analysis of the results shows that 39 percent of the companies experienced: An increase in the sales generation ratio in the year before failure when net operating assets were used as the base and A decrease in the sales generation ratio when total assets were used as the base. Furthermore, 35 percent of the companies showed the key ratio producing a return of 20 percent or more in the second year from failure when using profit/net operating assets, while only 2 percent of companies showed a return of 20 percent or more when using total asset.

Measuring Changes in Financial Health through Ratio Analysis

Liquidity

Analysis of the current ratio shows that in 65 percent of the companies there was no significant movement in this ratio in all five years before failure; while a further 19 percent of the companies only recorded a significant movement in the final year before failure. The liquid ratio follows a pattern with 71 percent of the companies showing no significant movement in all the five years before failure, while a further 13 percent recorded a significant movement in the final year.

The model

The results of the model were analyzed for the five years before failure to show where the total score had deteriorated by more than 30 percent in any single year. Where the score deteriorated for more than one year, which happened in 65 percent of the companies, only the earliest occurrence was recorded.

This produced the following.

Year before failure	Deterioration of score %
5	18
4	20
3	22
2	27

It can be seen that 87 percent of the companies would have gained at least two years warning of a significant change in financial health by using the model. One further comparison needs to be tested. That is, when using the model on a failed company, the score deteriorated in the years to failure and, when using the model on on-going company, the score remains constant or better still shows a steady increase year by year. In order to do this and produce an average score, the paper has identified 11 companies within the failed group whose total score profile follows a similar pattern, i.e. a rise in the total score profile follows a similar pattern, i.e. a rise in the total score from the fifth to the fourth year followed by a substantial decline in each year to failure. To provide a comparison, the paper then selected 11 on-going companies that could be classified as healthy. Healthy in this context requires that a company was:

- a) Maintaining its profitability
- b) Maintaining an appropriate level for net working capital and
- c) Increasing its equity base

The total scores were then combined for each group and an average calculated which produced the following:

	5	4	3	2	1
Failed group	0.78	1.11	0.76	0.19	-0.15
On-going group	1.67	1.81	1.81	2.11	2.26

While there are problems associated with combining data for companies and in the criteria for the selection of the on-going companies, these do not detract from the main purpose of this test, which is to show that the model measure changes in financial health – whether good or bad.

CONCLUSIONS

There is plenty of evidence of the development of ratios from the turn of the century to the present. It has been a slow process, with each small step forward being followed by years of consolidation; throughout this process there has evolved a set of traditional ratios which have been widely used and interpreted. Therefore, it was with some surprise that, using the data from the failed group of companies, found that the main traditional ratios did not produce the results expected. The most important finding was on key ratio where it is now clear that the capital base should be defined as total assets and not net operating assets. The reasons were discussed in the section covering the profitability ratios, and confirmed when testing the total failed group, where it was stated that 35 percent of the companies showed the key ratio producing a return of 20 percent or more using net operating assets as the base and only 2 percent or more when using total assets as the base. The observations on liquidity described the difficulty in interpreting the current ratio and, along with the liquid ratio; show that neither was responsive to changes in working capital. When testing the liquidity on the total failed group it was confirmed that over 65 percent of the companies showed no

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