Edith Cowan University

Research Online

1-1-2000

Reducing the redundancy of financial ratios and assessing the stability of financial patterns

Teck K. Hii
Edith Cowan University

REDUCING THE REDUNDANCY OF FINANCIAL RATIOS AND ASSESSING THE STABILITY OF FINANCIAL PATTERNS

BY

TECK KIONG, HII

(STUDENT NO. 0969246)

A thesis Submitted in Partial Fulfillment of the Requirements

of the Award of

Master of Business (Accounting)

at the Faculty of Business and Public Management, Edith

Cowan University, Perth, Western Australia.

PRINCIPAL SUPERVISOR: DR JANNE CHUNG

Date of Submission: 12th January 2000

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.

ABSTRACT

The purpose of this study was to examine the financial patterns of Australian industrial firms along the lines of Pinches et al.'s (1973; 1975) study. The financial ratios used in prior Australian corporate failure studies were used to derive a reduced set of factors that was predictive of corporate failure (e.g., Castagna & Matolcsy, 1981; Booth, 1983). These factors were examined for the short- and long-term stability of these factors. The set of firms used was selected from FINSELECT database, which covered the period from 1989 to 1997. A random list of 199 Australian industrial firms that survived between 1989 and 1997 was selected. A total of thirty-one unique financial ratios were calculated based on the models derived in prior Australian failure prediction studies. These financial ratios were factor analysed. The financial factors that were predictive of corporate failure were <u>Return on Investment</u>, <u>Short-Term Liquidity (I and II)</u>, <u>Financial Leverage (I and II)</u> and <u>Decomposition Measure</u>.

A series of tests were applied to determine short- and long-term stability. With the exception of <u>Return on Investment</u> (which was highly stable), the rest of the factors demonstrated a combination of moderate and low stability.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education;

(ii) contain any material previously published or written by another person except where due reference is made in the text; or

(iii) contain any defamatory material.

FULL NAME: (Please type)   Teck-Kiong, Hii

SIGNATURE: ████████████_____
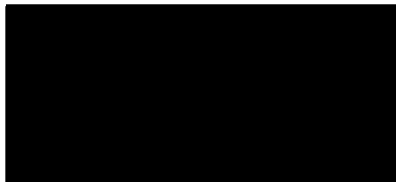
DATE: _29/02/2000_____

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE

Introduction

Motivation of the Study

Over the last few decades, empirical studies have repeatedly demonstrated the usefulness of financial ratios for prediction purposes. Financial ratios have played an important part in evaluating the performance and financial condition of an entity. These studies (e.g., Beaver, 1966; Altman, Haldeman & Narayanan, 1977) have shown the ability of the ratios to classify firms that either remained solvent or went into bankruptcy as early as five years prior to actual failure. There was, however, a lack of agreement concerning the ratios that were relevant in distinguishing between failed and non-failed firms. The reason was that these studies made used of different financial ratios in their failure prediction models, and many of these involved minor refinements to the existing models. Consequently, the usefulness of the specific ratios varied between the models and there was a high degree of overlap in terms of what that they each measured. For example, ratios such as: (1) "worth to total debt", (2) "worth to total assets", and (3) "total debt to total assets", were simply variants of the equation (total assets = total debt + net worth).

Pinches, Mingo and Caruthers (1973) and Pinches, Eubank, Mingo and Caruthers (1975) employed data reduction techniques to classify a set of financial ratios and examined the stability of these financial patterns over time. Since then, other studies had also adopted data reduction techniques by grouping the financial ratios into a few dimensions (e.g. Johnson, 1978; 1979; Laurent, 1979; Taffler & Sudarsanam, 1979;

Ezzamel, Brodie & Mar-Molinero, 1987) and examined the extent of cross-sectional stability of financial patterns (Johnson, 1978; 1979).

The present study departs from prior studies in three significant ways. First, research on the examination of financial patterns had been carried out in the United States (Pinches et al., 1973; 1975; Johnson, 1978; 1979), Hong Kong (Laurent, 1979), and the United Kingdom (Ezzamel et al., 1987; Taffler & Sudarsanam, 1979), and there was no research done in Australia along the lines of the Pinches et al. (1973; 1975) studies. The dissimilarity of a country's accounting practices and economic structures (Choi, Hino, Min, Nam, Ujie & Stonehill, 1983; Cairns, 1988; Altmam, 1984) indicated that these results might not be generalisable to an Australian context.

Second, the present study narrows the focus by examining the financial ratios used in prior Australian corporate failure prediction studies (Castagna & Matolcsy, 1981; Booth, 1983; Izan, 1984; Lincoln, 1984; McNamara, Cocks & Hamilton, 1988; Shailer, 1990; Constable & Woodliff, 1994). Prior studies (e.g., Ezzamel et al., 1987) chose ratios in general (i.e., based on its usefulness and popularity). The present study employed data reduction techniques to classify the financial ratios used in these Australian studies into a few dimensions in the development of corporate failure model.

Third, in selecting the set of financial ratios to be subjected to data reduction, various 'screening techniques' had been used by prior studies. For example, Pinches et al. (1973; 1975) employed 48 financial ratios that were previously used to investigate

corporate failure, bond ratings and financial distress of firms. They also employed

ratios that examined the size and growth of firms. Ezzamel et al. (1987) selected 53

financial ratios "using the criterion of usefulness and popularity as reflected in the

literature" (Ezzamel et al., 1987, p. 524). The diversity of the ratios employed in these

studies measured the overall financial state of firms. Thus, their usefulness was

limited, as it was unclear whether the findings could assist in the development of

corporate failure prediction model. The present study made use of all financial ratios

used in prior Australian corporate failure studies instead of selecting ratios based upon

some subjective criteria. As such, the applicable ratios could be reduced to a

manageable number of factors that increases the efficiency and effectiveness of

corporate failure prediction.

Structure of the Thesis

Chapter two describes the literature review that highlights the used of financial ratios

in the development of corporate failure prediction models. It also reviews the relevant

literature that examines the use of factor analysis in extracting empirically based

classification of financial ratios.

Chapter three addresses the theoretical framework of the study. It reviews a set of

ratios that were subjected to data reduction in prior studies.

Chapter four discusses the statistical tests that are employed to discover the financial

patterns underlying ratios that predict corporate failure of Australian industrial firms. It

also discusses how the data were collected and the justification for the selection of firms and financial ratios.

Chapter five discusses the extracted factors and the extent of stability of these factors.

Finally, in chapter six, conclusions were drawn about the research. The implications are discussed in terms of the decision-makers and researchers, and also explain the avenues of future research.

CHAPTER TWO

Literature Review

<u>Introduction</u>

This chapter reviews research findings relating to the importance of financial ratios in corporate failure prediction studies. Notwithstanding the considerable progress that had been made in predicting failed and non-failed firms, it was still a difficult task to integrate the findings and to compare studies across years or countries. The purpose of this review is to provide an outline on the use of financial ratios in prior corporate failure studies (e.g., Beaver, 1966). It also reviews the use of factor analysis technique to reduce the redundancy of financial ratios.

The research in corporate failure had evolved in the late 1960s and throughout the 1970s in the United States. These studies (e.g., Beaver, 1966; Altman, 1968) used publicly available data, such as a firm's financial statements, and statistical classification techniques to predict corporate failure. The scope of this review is limited to only studies of corporate failure prediction that used financial statement variables of industrial firms.[1] Other areas of empirical research related to corporate failure (notably behavioural studies) were not considered here. The reason for not considering behavioural studies was that they investigated the impact of accounting variations on decision making.

---

[1] Variables referred to financial ratios and non-financial ratios (e.g., number of directors in the company).

Corporate Failure Prediction Studies

The pioneering work of Beaver (1966) lay in his discovery that a number of indicators, largely financial ratios, could enable one to distinguish between a failed firm and a non-failed firm. Beaver applied a univariate approach in which the predictive ability of the ratios was analysed individually. His sample comprised failed and non-failed firms taken from 1954 to 1964, and was matched by industry and asset size. An original set of thirty ratios was reduced to a set of six factors. Each of these factors was the best predictor in its class in classifying firms as failed or non-failed. The best performing ratio was the "cash flow to total debt". The overall misclassification rate (measured by the holdout sample) was 13% for the year before failure and 22% for the fifth year before failure. "Net income to total assets" was the second best predictor, followed by "total debt to total assets", "working capital to total assets", "current ratio" and "no-credit interval" in declining order of predictive ability.

Although Beaver's (1966) predictors performed fairly well, the main difficulty with his approach was that the classification could take place for only one ratio at a time and there was a potential for finding conflicting classifications of any given firm according to various ratios. Most of Beaver's ratios were highly correlated (Zavgren, 1983). This might be problematic since "the original variables usually stand in such a complicated pattern of intercorrelations among one another that it cannot, without the danger of redundancy and inconsistency, speak of group differences with respect to each of them separately" (Tatsuoka, 1970, p. 55). Besides that, the univariate analyses might be susceptible to faulty interpretation and was potentially confusing (Altman,

6

1968). For example, a firm with a poor profitability and/or solvency record might be regarded as a potential failure. However, because of its above average liquidity, the situation might not be considered serious. Therefore, the potential ambiguity as to the relative performance of the firm was clearly evident.

Motivated by the above criticism of Beaver's (1966) model, Altman (1968) chose multiple discriminant analysis in order to assess whether the multivariate approach would improve the predictive ability of the failure models. The sample used by Altman (1968) was thirty-three manufacturers that filed a bankruptcy petition under Chapter X of the National Bankruptcy Act (USA) during the period 1946-1965. Altman chose five ratios from a list of twenty-two based on four criteria: (1) significance of each ratio, (2) evaluation of inter-correlations between the relevant ratios, (3) predictive accuracy, and (4) relevancy in failure prediction. The five standard ratios, which formed the Z-Score model, were categorised into liquidity, return on investment,[2] leverage, solvency, and activity. The model proved to be accurate in classifying 95% of the sample firms for the first year before failure and 36% for the fifth year before failure.

Altman et al. (1977) developed a Zeta model, which superseded Altman's (1968) Z-Score model. Several refinements in the statistical technique and adjustments to the data were made, and an updated sample was used. The sample consisted of 53 failed matched with 58 non-failed firms. Stepwise regression analysis was used to limit the

---

[2] Return on investment is also called profitability.

twenty-seven ratios to seven 'best' ratios (return on assets, stability of earnings, debt service, cumulative return on investment, liquidity, capitalisation, and size). The authors ranked the seven ratios based on six different tests and the results showed that the cumulative profitability ratio was the most predictive, followed by the stability of earnings ratio. The Zeta model for failure classification appeared to be quite accurate with successful classification of 96.2% of their sample one-year prior to failure and 69.8% accuracy up to five years prior to failure.

The practical usefulness of the Zeta discriminant analysis model of Altman et al. (1977) led to its acceptance by over three dozen financial institutions (Altman, 1983). Since then, there had been a considerable interest in developing and testing models for classifying and predicting corporate failure in non-U.S. countries, particularly in Australia. In the late 1970s, Australia experienced a relatively high corporate failure rate, which Altman and Izan (1981) estimated to be perhaps two or three times higher than that of the United States. The active financial environment in Australia motivated the assessment of the potential for serious financial problems in firms. Several studies (e.g., Castagna & Matolcsy, 1981; Booth, 1983; Izan, 1984; Lincoln, 1984; McNamara et al., 1988; Shailer, 1990; and Constable & Woodliff, 1994) developed models to classify firms as likely to fail or not fail in the Australian context.

Castagna and Matolcsy (1981) analysed 21 failed firms and a matched sample of 21 non-failed firms using a linear and quadratic discriminant structure. They examined ten financial ratios (Table 1) that had been found useful in discriminating between failed and non-failed firms in some of the past studies (e.g., Altman, 1968; Altman et

8

al., 1977). The ratios reflected measure of <u>Return on Investment</u> ("returns on shareholders funds", "earnings before interest and tax to total assets", "operating income to operating assets"), <u>Liquidity</u> ("quick ratio", "current ratio", "working capital to total assets"), <u>Coverage and Leverage</u> ("gross cash flow to total debt", "total debt to total assets"), and <u>Capitalisation</u> ("retained earnings to total assets", "market capitalisation to total debt").

Table 1

<u>A Summary of Financial Ratios Used in Prior Australian Corporate Failure Prediction Studies</u>

Ratios	Source
1. Returns on Shareholders Funds	Castagna &
2. Earnings Before Interest & Tax/Total Assets	Matolcsy (1981)
3. Operating Income/Operating Assets	
4. Quick Ratio	
5. Current Ratio	
6. Gross Cash Flow/Total Debt	
7. Total Debt/Total Assets	
8. Working Capital/Total Assets	
9. Retained Earnings/Total Assets	
10. Market Capitalisation/Total Debt	
11. Balance Sheet Decomposition Measure	Booth (1983)
12. Assets Decomposition Measure	
13. Liabilities Decomposition Measure	
14. Equities Decomposition Measure	
15. Earnings Before Interest & Tax/Tangible Total Assets	Izan (1984)
16. Earnings Before Interest & Tax/Interest Payments	
17. Current Assets/Current Liabilities	
18. Funded Debt (borrowings)/Shareholder Funds	
19. Market Value of Equity/Total Liabilities	

9

Ratios	Source
20. Cash Flow Before Tax/Current Liabilities	Lincoln (1984)
21. Current Assets/Total Assets	
22. Quick Assets/Current Assets	
23. Current Liabilities/Total Liabilities	
24. Quick Liabilities/Current Liabilities	
25. Retained Profits/Total Assets	
26. Total Liabilities/Total Assets	
27. Profit Before Interest & Tax/Total Assets	
28. Retained Earnings/Total Assets	McNamara, Cocks
29. Total Liabilities/Total Assets	& Hamilton (1988)
30. Shareholders Funds/Total Liabilities	
31. Current Assets/Total Liabilities	
32. Net Profit After Tax/Shareholders Funds	
33. Earnings Before Interest & Tax/(Shareholders Funds + Long Term Liabilities)	
34. Pretax Operating Income/Interest Expense	Shailer (1990)
35. Bad Debts Expense/Pretax Operating Income	
36. Current Assets/Retained Earnings (adjusted to eliminate tax-effect accounting)	
37. Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	
38. Cash/Current Assets	
39. Absolute Value of Income Before Tax, Interest & Depreciation/Current Liabilities (excluding overdrafts)	
40. Total Liabilities/Total Assets	Constable &
41. Retained Earnings/Total Assets	Woodliff (1994)
42. Market Value of Equity/Total Liabilities	
43. Funds From Operations/Total Liabilities	
44. Taxation Liability (benefit) Assessed/Before Tax Profit	

Lincoln (1984) extended the work of Castagna and Matolcsy (1981) by taking in larger

sample size of 41 failed and 80 industry-matched non-failed firms, covering the period

1969-1978. The ratio selection procedure used in Lincoln's (1984) study was different

from prior studies (e.g., Castagna & Matolcsy, 1981; Izan, 1984). Instead of using

10

predictive ratios based on prior studies, Lincoln set out five steps for compiling the ratios. The first step involved defining six streams of financial information: return on investment, cash flow, assets, liabilities, shareholders' funds, and working capital. The second step was to link the financial streams into a flow chart consisting of their accounting items (Table 2). The third step was to trace the paths of accounting items through the flow chart (Figure 1). The fourth step was to obtain a combination of ratios from the accounting items in a path. The fifth step was to select a set of ratios combination, taking into account firm size, variability in balance sheet items shown by the balance sheet decomposition measure, and variability in income flows. Following the examination of the ratios, a model was derived by examining the usefulness of financial ratios in describing the level of insolvency risk for both manufacturing and retail industries. It was suggested that a set of seven ratios (Table 1) was useful in discriminating between failed and non-failed firms. The ratios reflected measures of Cash Flow, Leverage, Liquidity, Borrowings, Short-Term Funding, Return on Investment, and Level of Borrowings.

Table 2

Financial Streams of Typical Accounting Items in the Profit Statement and Balance Sheet for a Public Firm

	Stream	Abbreviation
(1)	**Profit stream**	
	Profit available ordinary shareholders	PO
	+ Preference dividend	+ PD
	= Net profit	= NP
	+ Minority interests share of profit	+ MIP
	= Net operating profit	= NOP
	+ Tax	+ TAX
	= Net operating profit before tax	= PBT
	+ Interest	+ INT
	= Net operating profit before interest and tax	= PIT
(2)	**Cash flow stream**	
	Net operating profit	NOP
	+ Depreciation and long service leave	+ DLS
	= Cash flow	= CF
	+ Tax	+ TAX
	= Cash flow before tax	= CFB
(3)	**Asset stream**	
	Quick assets	QA
	+ Stock	+ STOCK
	= Current assets	= CA
	+ Fixed assets	+ FAI
	= Total assets	= TAI
(4)	**Liabilities stream**	
	Quick liabilities	QL
	+ Bank overdraft	+ BO
	= Current liabilities	= CL
	+ Deferred liabilities	+ DL
	= Total liabilities	= TL

12

Stream	Abbreviation
(5) Shareholders' funds stream	
Ordinary capital	OC
+ Retained profits	+ RP
= Ordinary capital + retained profits	= OCR
+ Other reserves	+ OTH
= Ordinary shareholders' funds	= SFO
+ Preference shares	+ PS
= Shareholders' funds	= SFI
+ Minority interests	+ MI
= Shareholders' funds + minority interests	= SFIM
(6) Working capital stream	
Current assets	CA
- Current liabilities	- CL
= Working capital	= WC

(Adapted from Lincoln, 1984, p. 325)
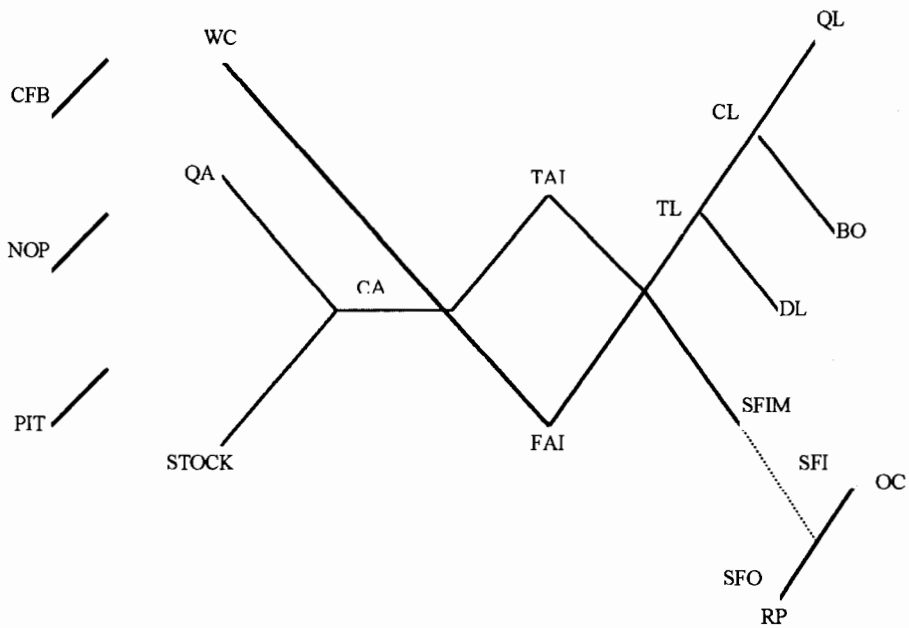
Note: CFB – Cash flow before tax
NOP – Net operating profit
PIT – Net operating profit before interest and tax
WC – Working capital
QA – Quick assets
STOCK – Stock
CA – Current assets
TAI – Total assets
FAI – Fixed assets
TL – Total liabilities
CL – Current liabilities
DL – Deferred liabilities
BO – Bank overdraft
QL – Quick liabilities
SFIM – Shareholders' funds + minority interests
SFI – Shareholders' funds

Adapted from Lincoln (1984, p. 326)

Figure 1. Flow Chart: cash flow, profit, assets, liabilities, working capital and shareholders' funds streams.

Izan (1984) developed a classification model consisting of five ratios (Table 1) that was sufficiently general to be applied across several industry sectors. The model included Return on Investment ("earnings before interest and taxes to tangible total assets"), Interest Coverage ("earnings before interest and taxes to interest payments"), Liquidity ("current assets to current liabilities"), Leverage ("funded debt to shareholder funds"), and Capital ("market value of equity to total liabilities").

McNamara et al. (1988) developed a model for identifying private unlisted firms that might soon fail. The prediction model was based on six (Table 1) out of the seventeen ratios that provided the best prediction of corporate failure. The discriminant analysis was performed using the stepwise variable extraction procedure.[3] The ratios reflected measures of Return on Investment ("retained earnings to total assets", "net profit after tax to shareholders funds"), Capital Structure ("total liabilities to total assets"), Financing ("shareholders funds to total liabilities", "earnings before interest and tax to shareholders funds + long-term liabilities"), and Leverage ("current assets to total liabilities").

In a related study, Booth (1983) investigated the used of the decomposition measure concepts (Table 1) in a model to predict corporate failure.[4] He aggregated the firm's assets, liabilities, equities and the balance sheet total over time between failed and non-failed firms. He constructed a six-variable model from these measures ("average

---

[3] "Stepwise estimation involved entering the independent variables into the discriminant function one at a time on the basis of their discriminating power" (Hair, Anderson, Tatham & Black, 1995, p. 84).

[4] Decomposition measure concepts was used to measure the change in the composition of these aggregate figures between financial statement dates (Lev, 1969; Theil, 1969).

15

liabilities decomposition measure", "balance sheet decomposition measure", "average

balance sheet decomposition measure", "equities decomposition measure", "average

equities decomposition measure" and "coefficient of variation of the equities

decomposition measure").

The formulae for the computation of the "total assets", "equities" and "liabilities"

decomposition measures is:

$$\sum_{i=1}^{n} q_i \, \log_e \frac{q_i}{p_i}$$

where

i = a subset of the appropriate total assets, equities or liabilities.
n = the number of subsets of each total.
q_i = total assets, equities or liabilities from the current year.
p_i = total assets, equities or liabilities from the previous year.

The results showed a classification accuracy of 63% for all firms. The Type I error

(misclassifying a failed firm) was 25% compared to the Type II error (misclassifying a

surviving firm) of 50%. This confirmed the results of other studies (Lev, 1969;

Walker, Stow & Moriarity, 1979) that decomposition measures had different

behaviour patterns from financial ratios.

Shailer's (1990) study was similar to Booth (1983) as it compared 'traditional'

accounting ratios (Table 1), information decomposition measures, and accounting

trend measures in multivariate discriminant models to predict corporate failure. Shailer

(1990) suggested that the results provided evidence that financial data other than the

traditional ratios could provide significant information that might improved the

performance of failure classification and possibly failure prediction models for

unlisted firms.[5]

Constable and Woodliff (1994) examined the ability of three prior failure prediction

models (Beaver, 1966; Altman, 1968; Castagna & Matolcsy, 1981) on a sample of 30

failed firms and 30 non-failed firms. The results showed that the models of Beaver

(1966) and Altman (1968) outperformed Castagna and Matolcsy model even though

the latter was developed using Australian data. The study also developed two new

models (10-variable model and 6-variable model) (Table 1) incorporating publicly

available information and some non-financial measures.[6, 7, 8] The results showed that

the two new models outperformed the past models in discriminating between the failed

and non-failed firms.

---

[5] The scope of the present study was limited to financial ratio analysis. Other financial statement analysis (e.g., trend) related to corporate failure prediction was not considered here.

[6] The 10-variable model consisted of (1) days between balance sheet date and signed audit report, (2) size of board of directors, (3) 1 if net income was negative for previous two years or 0 otherwise, (4) "retained earnings to total assets", (5) "funds from operations to total liabilities, (6) "total liabilities to total assets", (7) "total debt to total assets", (8) industry relative market value of equity to total liabilities, (9) "taxation liability (benefit) assessed to before tax profit, and (10) 2-year proportionate change in size of board of directors.

[7] The 6-variable model consisted of (1) days between balance sheet date and signed audit report, (2) size of board of directors, (3) 1 if net income was negative for previous two years or 0 otherwise, (4) "retained earnings to total assets", (5) "funds from operations to total liabilities, and (6) "total liabilities to total assets".

[8] The present study was only interested in financial ratios. Non-financial ratios (e.g., size of board of directors, 2-year proportionate change in size of board of directors) were not included in the study.

Outline of the Literature on the Use of Factor Analysis in the Context of Financial Ratios

Most early corporate failure models, including the path-breaking work of Beaver (1966) and Altman (1968) did not rest on any explicit theory but on empirically derived models (Scott, 1981). These empirical studies had demonstrated the usefulness of financial ratios in predicting corporate failure. Naturally, different studies often included different ratios. Consequently, there was a proliferation of financial ratios that had been found to be evaluative.[9] It was proposed that financial analyses would be enhanced if this redundancy was removed by identifying a sub-set of independent financial ratios. In a series of studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Taffler & Sudarsanam, 1987; Laurent, 1979; Ezzamel et al., 1987), factor analysis was employed to reduce a large set of financial ratios into a smaller number of dimensions. The empirically based classifications of financial ratios extracted by past studies are reported in Table 3.

---

[9] At the last count, there were more than 242 unique financial ratios used in prior corporate failure studies.

Table 1

A Summary of Previous Research on the use of Factor Analysis in the Context of Financial Ratios

	Study	Country	Years	Sample Size	Number of Ratios Used	Number of Factor Extracted	Return on Investment	Capital Intensiveness	Inventory Intensiveness	Financial Leverage	Receivables Intensiveness	Short-Term Liquidity	Cash Position	Working Capital Management	Decomposition Measure	Standing Charges Cover	Income Retention	Value Added	Creditors Position	Loose Ends
1.	Pinches, Mingo & Caruthers (1973)	USA	1951; 1957; 1963; 1969	221 Industrial	48	7	1	2	3	4	5	6	7	-	-	-	-	-	-	-
2.	Pinches, Eubank, Mingo & Caruthers (1975)	USA	1966; 1967; 1968; 1969	221 Industrial	48	7	1	2	3	4	5	6	7	-	-	-	-	-	-	-
3.	Johnson (1978; 1979)	USA	1972	306 Manufacturing 159 Retail	61	9	1	3	4	2	6	7	5	-	8	-	-	-	-	9
4.	Taffler & Sudarsanam (1979)	UK	1978	525 Manufacturing	80	9	1	4[a]	-	2	8[b]	5	-	3	-	-	9[c]	6	7	-
5.	Laurent (1979)	Hong Kong		63 Trading	45	10	1	4[d]	7	2,5	10[e]	6	-	3	-	8	9	-	-	-
6.	Ezzamel, Brodie & Mar-Molinero (1987)	UK	1973; 1977; 1981	842 Manufacturing	53	10	2,7	1,6,9[f]	8	5	-	4,10	-	3	-	-	-	-	-	-
7.	Present study	Australia	1989; 1993; 1997	200 Indust.	26	6	1	-	-	3,5	-	2,4	-	-	-	6	-	-	-	-

Note.
Adapted from Ezzamel et al. (1987, p. 521)

[a] – Taffler and Sudarsanam (1979) identified this factor as Asset Turnover.
[b] – Taffler and Sudarsanam (1979) identified this factor as Credit Policy.
[c] – Taffler and Sudarsanam (1979) identified this factor as Dividend Position.
[d] – Laurent (1979) identified this factor as Fixed Asset Management.
[e] – Laurent (1979) identified this factor as Credit Policy.
[f] – Ezzamel, Brodie and Mar-Molinero (1987) identified Factors 6 and 9 as Asset Turnover.

Pinches et al. (1973) attempted to provide information pertinent to an understanding of the empirical similarity exhibited by the various financial ratios employed in prior testing. The purpose of their study was to employ data reduction techniques to classify a set of forty-eight financial ratios into a smaller number of factors. These ratios were used to investigate corporate failure, bond ratings and financial distress of the firm. They also employed ratios that examined the size and growth of the firm. Seven factors (Return on Investment, Capital Intensiveness, Inventory Intensiveness, Financial Leverage, Receivables Intensiveness, Short-Term Liquidity, and Cash Position) were found to measure the overall financial profile of a firm. Another purpose of their study was to measure the stability of these factors over time, and the results showed the overall stability of some of the factors. These were Return on Investment, Inventory Intensiveness, Financial Leverage, Short-Term Liquidity, and Cash Position. Receivables Intensiveness and Capital Intensiveness, however, were found to be unstable over time. Using the same set of ratios and the sample of firms, Pinches et al. (1975) found in a follow-up study that these seven factors also possessed considerable short-term stability between the period 1961 and 1969.

Johnson (1978) had the same objective as Pinches et al. (1973). He empirically classified a set of financial ratios into a smaller number of dimensions and examined the extent of cross-sectional (comparing the financial patterns of manufacturing and retail firms) stability of these financial patterns. He made use of 40 financial ratios examined by Pinches et al. (1973; 1975) and several decomposition measures (Theil, 1969; Lev, 1969). The results showed that the financial ratios factor patterns that were common to both retail and manufacturing firms were Return on Investment, Financial

20

Leverage, Capital Intensiveness, Inventory Intensiveness, Cash Position, Receivables Intensiveness, Short-Term Liquidity and Decomposition measures. The results also indicated a high degree of stability in terms of the consistency of factor loadings across the two industrial groups for the year.

In a subsequent study, Johnson (1979) examined the factors extracted from his previous study (Johnson, 1978) for cross-sectional stability for two different types of firms (retailers and primary manufacturers) between the years (1972 and 1974). The results showed similarity between the eight factors extracted for retailers and primary manufacturers. The factors were found to be stable across the two industries within the two periods.

Using Hong Kong data, Laurent's (1979) objective was also to classify a set of 45 financial ratios identified by Courtis (1978) into a smaller number of dimensions that measured the overall financial profile of a firm. These were Return on Investment, Gearing, Working Capital Management, Fixed Asset Management, Long-Term Solvency, Short-Term Solvency, Inventory Management, Standing Charges Cover, Income Retention Policy, and Credit Policy.

The purposes of Ezzamel et al. (1987) study were to employ factor analysis on a set of 53 unique financial ratios and examine the stability of these financial patterns over the long-term (between the period 1973 and 1981) in a UK context. The ratios were selected "using the criterion of usefulness and popularity reflected in the literature" (Ezzamel et al., 1987, p. 524). Ten factors were extracted and they were Capital

Intensiveness, Return on Investment I, Working Capital Management, Liquidity I, Long-Term Debt, Asset Turnover I, Return on Investment II, Inventory, Asset Turnover II and Liquidity II. The results showed overall stability for Inventory, Long-Term Debt and Working Capital Management. Liquidity and Return on Investment (I and II) were found to be moderate stable over time. Capital Intensiveness and Asset Turnover were unstable.

Conclusion

A number of conclusions could be drawn from the literature review. First, most prior studies selected financial ratios because of their popularity and predictive success in previous studies (Jones, 1987). Consequently, different researchers included different ratios in their failure prediction models. Therefore, redundancy was a problem. The factor analysis technique was employed in a series of studies (e.g., Pinches et al., 1973; 1975; Johnson, 1978; 1979; Taffler & Sudarsanam, 1979; Laurent, 1979; Ezzamel et al., 1987) to consider the possibility of grouping the financial ratios into a smaller number of dimensions.

Second, the empirically based classifications of ratios extracted by Pinches et al. (1973; 1975), Johnson (1978; 1979), Taffler and Sudarsanam (1979), Laurent (1979) and Ezzamel et al. (1987) had shown some disparity on the number of factors extracted and the order of these factors (Table 3). Overall, it showed that the four factors (Return

on Investment, Capital Intensiveness,[10] Financial Leverage and Short-Term Liquidity) were shared by all the seven studies. Inventory Intensiveness, was shared by six studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979; Ezzamel et al., 1987). Apart from Ezzamel et al. (1987), all prior studies had identified a Receivables Intensiveness factor.[11] Cash Position was extracted in Pinches et al.'s (1973; 1975) and Johnson's (1978; 1979) studies. Taffler and Sudarsanam (1979), Laurent (1979) and Ezzamel et al. (1987) extracted a Working Capital Management factor in their studies. Decomposition Measure was found in Johnson's (1978; 1979) studies. Standing Charges Cover was extracted from Hong Kong data (Laurent, 1979). Income Retention was identified in Taffler and Sudarsanam's (1979) and Laurent's (1979) studies.[12] Value Added and Creditors Position were found in Taffler and Sudarsanam's (1979) study.

In terms of the order of these factors (Table 3), Return on Investment was found to be in the first factor for most studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979; Taffler & Sudarsanam, 1979). Capital Intensiveness was the second factor in Pinches et al. (1973; 1975), the third factor in Johnson (1978; 1979), the fourth factor in Taffler and Sudarsanam (1979) and Laurent (1979), and the first, sixth, and ninth factors in Ezzamel et al. (1987). Inventory Intensiveness was the third factor in Pinches et al. (1973; 1975), the fourth factor in Johnson (1978; 1979), the seventh

---

[10] Taffler and Sudarsanam (1979) and Ezzamel et al. (1987) called this the Asset Turnover factor, while Laurent (1979) called this the Fixed Asset Management factor.

[11] Taffler and Sudarsanam (1979) and Laurent (1979) called this the Credit Policy factor.

[12] Taffler and Sudarsanam (1979) called this the Dividend Position factor.

factor in Laurent (1979) and eighth factor in Ezzamel et al. (1987). <u>Financial Leverage</u> was the fourth factor in Pinches et al. (1973; 1975), the second factor in Johnson (1978; 1979) and Taffler and Sudarsanam (1979), the second and the fifth factors in Laurent (1979), and the fifth factor in Ezzamel et al. (1987).<u>Receivables Intensiveness</u> was the fifth factor in Pinches et al. (1973; 1975), the sixth factor in Johnson (1978; 1979), the eighth factor in Taffler and Sudarsanam (1979) and the tenth factor in Laurent (1979). <u>Short-Term Liquidity</u> was the sixth factor in Pinches et al. (1973; 1975) and Laurent (1979), the seventh factor in Johnson (1978; 1979), the fifth factor in Taffler and Sudarsanam (1979), and the fourth and the tenth factors in Ezzamel et al. (1987). <u>Cash Position</u> was the seventh factor in Pinches et al. (1973; 1975) and the fifth factor in Johnson (1978; 1979). <u>Working Capital Management</u> was found to be in the third factor in Taffler and Sudarsanam's (1979), Laurent's (1979) and Ezzamel et al.'s (1979) studies. <u>Decomposition Measure</u> was the eighth factor in Johnson (1978; 1979). <u>Standing Charges Cover</u> was the eighth factor in Laurent (1979). <u>Income Retention</u> was the ninth factor in Taffler and Sudarsanam (1979) and Laurent (1979). <u>Value Added</u> and <u>Creditors Position</u> were the sixth and the seventh factors respectively in Taffler and Sudarsanam (1979).

Overall, the factors extracted and the order of these factors showed substantial differences (see Table 3). Such disparity offered little comfort to researchers who wished to make use of these results as a guide for choosing a small number of 'representative' ratios for their corporate failure models. Hence, this reinforced the need for the present study to examine the financial ratios to corroborate past results and to establish a set of factors that were specific to Australia.

Third, Pinches et al. (1973; 1975), Johnson (1978; 1979), Taffler and Sudarsanam (1979), Laurent (1979) and Ezzamel et al. (1987) examined financial ratios in general. The limitation of examining the ratios in general was that its usefulness would be limited, that is, it would be unclear whether the results could be generalised to corporate failure prediction. Hence, this provided an opportunity for the present study to extract factors based on the ratios that were found useful in corporate failure studies.

CHAPTER THREE

Model and Theoretical Framework

<u>Introduction</u>

This chapter first provides a discussion regarding the grouping of financial ratios

derived in prior studies in general (Pinches et al., 1973; 1975; Johnson, 1978; 1979;

Laurent, 1979; Taffler & Sudarsanam, 1979; Ezzamel et al., 1987). Second, it

examines the financial patterns that applied specifically to corporate failure prediction.

Third, it discusses the evidence from prior studies that examined the stability of the

financial patterns.

<u>Diversity of Factors</u>

Prior studies (e.g., Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979;

Taffler & Sudarsanam, 1980; Ezzamel et al., 1987) suggested that financial ratios may

be grouped into specific dimensions and offered empirical support for the grouping of

these financial ratios. These studies made use of financial ratios that examined many

aspects of a firm's financial state, from ratios that were used to examine corporate

failure to ratios that investigated the size and growth of a firm. For example, Pinches et

al. (1973; 1975) employed financial ratios to investigate corporate failure, bond ratings

and financial distress of the firm. They also employed ratios that examined the size and

growth of the firm. The set of ratios was grouped into <u>Return on Investment</u>, <u>Capital</u>

<u>Intensiveness</u>, <u>Inventory Intensiveness</u>, <u>Financial Leverage</u>, <u>Receivables Intensiveness</u>,

<u>Short-Term Liquidity</u> and <u>Cash Position</u>.

Johnson (1978; 1979) made use of 40 ratios from the set of ratios employed by Pinches et al. (1973; 1975) together with several financial decomposition measures (Theil, 1969; Lev, 1969). The classification resulted in eight financial patterns (Return on Investment, Financial Leverage, Capital Intensiveness, Inventory Intensiveness, Cash Position, Receivables Intensiveness, Short-Term Liquidity and Decomposition Measures. Each of these dimensions described a unique aspect of a firm's activities.

Laurent (1979) and Ezzamel et al. (1987) selected ratios using the criterion of usefulness and popularity to summarise the inter-relationships among the ratios into a few factors. Laurent (1979) identified ten factors (Return on Investment, Gearing, Working Capital Management, Fixed Asset Management, Long-Term Solvency, Short-Term Solvency, Inventory Management, Standing Charges Cover, Income Retention Policy and Credit Policy) that measure the financial position of the firm. Ezzamel et al. (1987) also identified ten factors (Capital Intensiveness, Return on Investment I, Working Capital, Liquidity I, Long-Term Debt, Asset Turnover I, Return on Investment II, Inventory, Asset Turnover II and Liquidity II) representing the financial patterns for UK manufacturing companies.

These prior studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979; Taffler & Sudarsanam, 1979; Ezzamel et al., 1987) derived 13 factors (excluding Loose Ends) (Table 3) that were found to be useful evaluators of the overall financial position of the firm. This group of financial dimensions may be grouped into two broad categories – major and minor factors. Major factors were identified by a

majority of prior studies, while minor factors were identified by one or two of these studies.

Major Factors

Return on Investment

Apart from Ezzamel et al. (1987), all prior studies identified this factor to be the most dominant (Table 3).[13] It measures the rate of return generated by a firm. The ability of a firm to earn an "adequate" return from its investment determines its ability to attract new investment and its operating efficiency (Popoff & Cowan, 1989; Weygandt, Kieson & Kimmel, 1998).

Capital Intensiveness

It measures a firm's ability to utilise its capital efficiently. A firm's efficiency in generating income could be interpreted as the efficient use of its assets in its operations. Business activities are carried on through the investment of finances for the purpose of generating income. It was the second factor in Pinches et al. (1973; 1975), the third factor in Johnson (1978; 1979), the fourth factor in Taffler and Sudarsanam (1979) and Laurent (1979),[14, 15] and the first, sixth and ninth factor in Ezzamel et al. (1987) (Table 3).[16]

---

[13] It was the second and seventh factor in Ezzamel et al.'s (1987) study.

[14] Taffler and Sudarsanam (1979) identified this factor as <u>Asset Turnover</u>. It measures a firm's efficiency in utilising its resources by investing them in assets to generate income.

28

Inventory Intensiveness

It measures the efficiency by which inventory is managed. Apart from Taffler and Sudarsanam (1979), the factor had been previously identified by all the prior studies (Table 3). It was the third factor in Pinches et al. (1973; 1975), the fourth factor in Johnson (1978; 1979), the seventh factor in Laurent (1979) and the eighth factor in Ezzamel et al. (1987).

Financial Leverage

It measures a firm's capability of meeting debt payments when they become due. It was the second factor in Johnson (1978; 1979) and Taffler and Sudarsanam (1979), the fourth factor in Pinches et al. (1973; 1975), the fifth factor in Ezzamel et al. (1987) and the second and the fifth factor in Laurent (1979) (Table 3).[17]

Receivables Intensiveness

It assesses the firm's ability to control receivables and measures the liquidity of receivables. It was the fifth factor in Pinches et al. (1973; 1975), the sixth factor in Johnson (1978; 1979), the eighth factor in Taffler and Sudarsanam (1979) and the

---

[15] Laurent (1979) identified this factor as Fixed Asset Management. It measures a firm's efficiency in utilising fixed assets to generate revenue.

[16] Ezzamel et al. (1987) identified Factors 6 and 7 as Asset Turnover. These factors are concerned with asset management and are related to Capital Intensiveness.

[17] Laurent (1979) found two financial leverage factors.

tenth factor in Laurent (1979) (Table 3).[18, 19] Ezzamel et al. (1987) did not identify this as a separate factor.

Short-Term Liquidity

Short-Term Liquidity measures a firm's ability to pay its maturing obligations in the short-term. For a firm to meet its current obligations, it requires liquid assets that could be quickly converted to cash. It was the fifth factor in Taffler and Sudarsanam (1979), the sixth factor in Pinches et al. (1973; 1975) and Laurent (1979), the seventh factor in Johnson (1978; 1979), and the fourth and tenth factor in Ezzamel et al. (1987) (Table 3).[20]

Cash Position

This factor measures the liquidity of a firm. Cash is the most liquid asset owned by a firm. It was the fifth factor in Johnson (1978; 1979) and the seventh factor in Pinches et al. (1973; 1975) (Table 3). Taffler and Sudarsanam (1979), Laurent (1979) and Ezzamel et al. (1987) did not identify this as a separate factor.

---

[18] Taffler and Sudarsanam (1979) identified this factor as Credit Policy. This factor is concerned with the amount of credit that is extended to the debtors, and is similar to Receivables Intensiveness factor.

[19] Laurent (1979) identified this factor as Credit Policy. The description of this factor is also similar to Receivables Intensiveness factor.

[20] Ezzamel et al. (1987) found two short-term liquidity dimensions.

Working Capital Management

It indicates a firm's ability to meet its existing current obligations. Working capital encompasses all aspects of the administration of both the current assets and the current liabilities. It was the third factor in Taffler and Sudarsanam (1979), Laurent (1979), Ezzamel et al. (1987) (Table 3). Pinches et al. (1973; 1975) and Johnson (1978; 1979) did not identify this as a separate factor.

Minor Factors

Decomposition Measure

It measures the change in the composition of the aggregate figures between financial statement dates (Lev, 1969). Apart from Johnson (1978; 1979), all prior studies did not identify this as a separate factor (Table 3).[21]

Standing Charges Cover

Standing Charges Cover is concerned with liquidity relative to long-term debt. It measures the aspect of a firm's liquidity in relation to owner's equity and the ability of the firm to meet interest payments as they become due. Apart from Laurent (1979),[22] all prior studies did not identify this as a separate factor (Table 3).

---

[21] It was the eight factor in Johnson's (1978; 1979) study.

[22] It was the eighth factor in Laurent's (1979) study.

31

Income Retention Policy

The undistributed portion of income or profits is called retained income (Horngren, Sundem & Elliott, 1993). This factor (Income Retention) discloses specific intentions of management in utilising profits for the purposes of either distributing dividends or reinvesting the profits in purchasing new plant equipment. Apart from Taffler and Sudarsanam (1979) and Laurent (1979),[23, 24] all prior studies did not identify this as a separate factor (Table 3).

Value Added

This factor reflects the improvement made on the assets by the firm. For example, when a firm buys a building, its intention is to extend the building and such extension increases the value of the asset. It was the sixth factor in Taffler and Sudarsanam's (1979) study. Pinches et al. (1973; 1975), Johnson (1978; 1979), Laurent (1979) and Ezzamel et al. (1987) did not identify this factor in their study (Table 3).

Creditors Position

This factor reflects the day-to-day operating activities of a business. It is a short-term obligation to suppliers for goods or services purchased on credit. Apart from Taffler

---

[23] Taffler and Sudarsanam (1979) identified this factor as Dividend Position. It determines the division of earnings between payments to shareholders and reinvestment in the firm. It has similar description as Income Retention.

[24] It was the ninth factor in Laurent's (1979) study.

and Sudarsanam (1979), all prior studies did not identify this as a separate factor (Table 3).[25]

Important Factors in Failure Prediction

The present study expects the factors extracted to be different from prior studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979; Taffler & Sudarsanam, 1980; Ezzamel et al., 1987) because of the type of ratios used in the analyses. This study examines only financial ratios used in prior Australian corporate failure studies. It contrasted prior studies that selected their ratios based on their usefulness and popularity. These prior Australian corporate failure studies had indicated that the ratios that were frequently used in their models reflected measures of either Return on Investment, Liquidity, Leverage, Capital Structure, Interest Coverage or Capitalisation. For example, Castagna & Matolcsy (1981) and Lincoln (1984) adopted ratios that reflected measures of Return on Investment,[26] Liquidity, Coverage and Capitalisation, and Leverage. Izan (1984) made use of ratios that reflected measures of Return on Investment,[27] Interest Coverage, Liquidity, Leverage and Capital Structure. Booth (1983) employed financial decomposition measures to predict corporate failure. McNamara et al. (1988) made use of ratios that reflected measures of Return on Investment,[28] Capital Structure and Financial Leverage. These ratios may

---

[25] It was the seventh factor in Taffler and Sudarsanam's (1979) study.

[26] Castagna and Matolcsy (1981) and Lincoln (1984) called this factor as Profitability.

[27] Izan (1984) called this factor as Profitability.

[28] McNamara et al. (1988) called this factor as Profitability.

be broadly classified into four dimensions – Return on Investment (which is a measure of profitability), Liquidity (which measures the ability of a firm to meet its debt payments), Leverage (which represents the extent of reliance to debt and includes ratios describing capital structure, interest coverage and capitalisation), and the Decomposition Measure (which is inherently different from other dimensions). Therefore, the first research question of this study asked:

Q1 – Can the factors that predict corporate failure be classified into Return on Investment, Liquidity, Leverage and Decomposition Measure dimensions?

The Extent of Stability of Financial Patterns

Pinches et al. (1975) found seven financial factors to have short-term stability – Return on Investment, Capital Intensiveness, Inventory Intensiveness, Financial Leverage, Receivables Intensiveness, Short-Term Liquidity and Cash Position (Table 4). The stability of these financial patterns indicated that the firms were in sound financial position (Dambolena and Khoury, 1980) [29]. For example, Return on Investment offered a measure of management effectiveness and should reflect stability. The stability of Capital Intensiveness and Inventory Intensiveness indicated the efficiency of employing capital and managing inventory, respectively. Financial Leverage and Short-Term Liquidity constituted measures of a firm's solvency, therefore the stability

---

[29] In Dambolena and Khoury's (1980) study, they examined the effectiveness of incorporating stability ratios in their corporate failure model. They found that the inclusion of stability ratios in the analysis improved considerably the ability of the discriminant function to predict failure. They suggested that ratio stability was an indication of a firm's survival.

of these factors were directly related to the wise use of leverage. Finally, the stability

of Receivables Intensiveness and Cash Position reflected the efficiency of controlling

receivables and handling of cash, respectively.

Table 4

Summary of Previous Research on the Stability of the Factors

Factor Name	Pinches, Eubank, Mingo & Caruthers (1975) (short-term stability)	Pinches, Mingo & Caruthers (1973) (long-term stability)	Ezzamel, Brodie & Mar-Molinero (1987) (long-term stability)
Return on Investment	0	0	1
Capital Intensiveness	0	2	2
Inventory Intensiveness	0	0	0
Financial Leverage	0	0	0
Receivables Intensiveness	0	2	-
Short-Term Liquidity	0	0	1
Cash Position	0	0	-
Working Capital Management	-	-	0
Asset Turnover	-	-	2

Note.

0 denotes high stability
1 denotes moderate stability
2 denotes instability

Pinches et al. (1973) and Ezzamel et al. (1987) found mixed results for the stability of

the financial factors over the long-term. Pinches et al. (1973) found five factors

(Return on Investment, Inventory Intensiveness, Financial Leverage, Short-Term

Liquidity and Cash Position) to be stable over the long-term, while Ezzamel et al. (1987) found three factors (Inventory Intensiveness, Financial Leverage and Working Capital Management) to have long-term stability. Ezzamel et al. (1987) found Short-Term Liquidity and Return on Investment to be moderate stable.

Pinches et al. (1973) observed much less stability over time for Receivables Intensiveness and Capital Intensiveness, while Ezzamel et al. (1987) found Capital Intensiveness and Asset Turnover to be unstable over a long-term period.

The instability of these financial factors over the long-term period could be attributed to changes in corporate strategy, the competitive nature of the market and technological changes (Platt & Platt, 1990). For example, the reason for the factor – Capital Intensiveness to be unstable could be related to the expansion of the firm's activities. If more capital were used in the acquisition of assets, the ratios loading in the factor would show remarkable differences between the two positions (expansion and no expansion). This would cause the factor to be unstable. Similarly, the instability of Short-Term Liquidity represented the excessive use of short-term loans to finance business expansion. This discussion led to the following research question:

Q2 – Are the Return on Investment, Liquidity, Leverage and Decomposition Measure factors stable over the short- and long-term?

Conclusion

Thirteen factors had been found by researchers (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979; Taffler & Sudarsanam, 1979; Ezzamel et al., 1987) to encompass all relevant aspects of a firm's financial profile.

The stability of the financial pattern was questionable as mixed results were found (Pinches et al., 1973; 1975; Ezzamel et al., 1987). Pinches et al. (1975) found short-term stability in their factors. Pinches et al. (1973) reported long-term instability for the two factors (Receivables Intensiveness and Capital Intensiveness). Ezzamel et al. (1987) reported long-term instability for Capital Intensiveness and Asset Turnover.

CHAPTER FOUR

Methodology

Introduction

This chapter first provides a discussion regarding the statistical techniques used in the analyses. Second, it discusses the data collection process. Third, the selection of financial ratios from prior studies is explained. Fourth, sample size is discussed.

Statistical Technique

The multivariate statistical technique of factor analysis was employed in the present study. Factor analysis is utilised to reduce a large set of ratios into a few factors that retained the maximum information contained in the original set of ratios (Tabachnick & Fidell, 1996; Hair, Anderson, Tatham & Black, 1995). It analyses the structures of financial ratios that are correlated among a large number of ratios by defining a set of common underlying dimensions that are known as factors. The statistical package SPSS (Statistical Package for the Social Sciences) (Norušis/SPSS Inc., 1994) was used.

Data Collection

The sample of firms for this study was gathered from the published annual financial statements of public limited liability firms listed on the Australian Stock Exchange. Other sources of information (like newspapers) were utilised to compute the market

capitalisation of individual firms for each of the years (1989, 1993 and 1997).[30] The

set of firms was selected from the FINSELECT (Financial Statistics on Listed

Companies) database,[31] which covered the period 1988 to 1997. In selecting the

sample, four criteria were considered: industry classification, country of registration,

financial year-ends, and the years to be selected.

First, all industrial classification would be included in the sample. Financial

institutions were excluded because "their ratios and cash flows were always

substantially different from those of other types of firms" (Mossman, Bell, Swartz &

Turtle, 1998, p. 40).[32] Mining firms were also excluded from the sample as "they

represent a dissimilar group in that they used different accounting principles and they

are predominantly exploration firms that had little content in their annual financial

statements" (Booth, 1983, p. 68).[33]

Second, only firms registered in Australia were included in the sample.

---

[30] Market capitalisation was computed by multiplying share price with the ordinary shares. The share price information was based on the company end of financial period. For example, if the company's end of financial period were on 30 June, then the share price would be based on that date.

[31] The FINSELECT database consisted of 1300 listed companies (industrials sector) located at Edith Cowan University Library CD-ROM NETWORK.

[32] Banks, building societies, credit unions, insurance companies, finance companies and merchant banks are typical examples of financial institutions under ED 63 (Australian Accounting Research Foundation [AARF], Auditing Standards Board [ASB], 1996, para. 11).

[33] For example, AASB 1022 (Australian Accounting Standards Board [AASB], 1996) allowed for different treatments of inventories (AASB, 1996, para. 50) and the point of recognition of sales revenue (AASB, 1996, para. 60) as opposed to industrial companies.

Third, all Australian industrial firms were included in the sample irrespective of their financial year-end. Restricting the sample to firms with the same year-end was too selective since such firms might share some characteristics with firms with different financial year-ends (Ezzamel et al., 1987).

Fourth, it was decided to perform data reduction on the ratios of three separate years: 1989, 1993 and 1997. The year 1989 was chosen because it was two years after the 1987 stock market crash and the second earliest year available in FINSELECT database. 1997 was chosen because it was the latest year available at the time of data collection. The year 1993 was chosen because it broke the 1989 – 1997 period into two equal time segments. This method had been used in the literature (e.g. Pinches et al. (1973) broke the 1951 – 1969 time period in three equal time segments, whereas Ezzamel et al. (1987) broke the 1973 – 1981 into two equal time segments). In order to test for stability (both long-term and short-term), only those industrial firms that had 1988 – 1997 financial statements were selected. The reason that the year 1988 was included in the observation was because the calculation of some ratios required the prior year's financial results.[34] The period chosen (1989 – 1997) represented a time of strong economic growth (3%) in the Australian economy (Anonymous, 1997).

---

[34] "Taxation Liability (benefit) Assessed to Before Tax Profit (Loss)", "Liabilities Decomposition Measure", "Asset Decomposition Measure", and "Equities Decomposition Measure".

The Selection of Financial Ratios

The ratios used in this study were based on the population of ratios used in prior Australian failure prediction studies (Castagna & Matolcsy, 1981; Booth, 1983; Izan, 1984; Lincoln, 1984; McNamara et al., 1988; Shailer, 1990; Constable & Woodliff, 1994). Table 1 provides a summary of the population of financial ratios was used.

The 44 financial ratios used in prior Australian corporate failure studies were screened for uniqueness by omitting those ratios that were close to others in terms of definition (Table 1). Ten ratios ("current ratio", "gross cash flow to total debt", "total debt to total assets", "market capitalisation to total debt", "total liabilities to total assets", "profit before interest and tax to total assets", "retained earnings to total assets", "total liabilities to total assets", "earnings before interest and tax to shareholders funds + long term liabilities", "retained earnings to total assets") were excluded because they were referred to more than once. This left a set of thirty-two unique financial ratios, of which, one ratio ("bad debts expenses to pretax operating income") could not be calculated. This was due to either an insufficient number of industrial firms having "bad debt expenses" during the 1997 time period or it was not disclosed in the database. This left final thirty-one financial ratios (Table 5).

<u>Table 5</u>

<u>Financial Ratios Used in the Analysis</u>

1   Quick ratio[1]
2   Balance Sheet Decomposition Measure
3   Cash flow before tax[2]/current liabilities
4   Assets Decomposition Measure
5   Current assets/current liabilities
6   Current assets/total assets
7   Current assets/total liabilities
8   Equities Decomposition Measure
9   Current liabilities/total liabilities
10   Earnings before interest and tax/interest payments
11   Returns on shareholders funds[3]
12   Earnings before interest and tax/tangible total assets
13   Earnings before interest and tax/total assets
14   Operating income/operating assets[4]
15   Funded debt (borrowings)[5]/shareholder funds
16   Funds from operations[6]/total liabilities
17   Absolute value of income before tax, interest and depreciation/current
     liabilities (excluding overdrafts)
18   Cash/current assets
19   Liabilities Decomposition Measure
20   Market value of equity[7]/total liabilities
21   Net profit after tax/shareholders funds
22   Quick assets[8]/current assets
23   Quick liabilities[9]/current liabilities
24   Retained earnings/total assets
25   Shareholders funds/total liabilities
26   Taxation liability (benefit) assessed[10]/before tax profit (loss)
27   Total liabilities/total assets
28   Current liabilities (excluding overdrafts)/(cash + market value of listed
     securities + net trade debtors)
29   Working capital[11]/total assets
30   Pretax operating income/interest expense
31   Current assets/retained earnings (adjusted to eliminate tax-effect accounting)[12]

<u>Note.</u>   Components of the ratios are defined as:
          [1] – Quick ratio = current assets – inventory/current liabilities – bank
               overdraft;
          [2] – Cash flow before tax = net operating profit + depreciation + long
               service leave + tax;
          [3] – Returns on shareholders funds = earnings before interest and
               tax/shareholders funds;
          [4] – Operating assets = current assets;

^{5} – Funded debt (borrowings) = debentures + mortgages + secured borrowings;

^{6} – Funds from operations = operating profit (loss) + depreciation + amortisation;

^{7} – Market value of equity = share price x ordinary shares;

^{8} – Quick assets = current assets – inventories – unlisted investments;

^{9} – Quick liabilities = current liabilities – bank overdraft;

^{10}– Taxation liability (benefit) assessed = current-period tax expense + change in deferred tax liability – change in future tax benefit;

^{11}– Working capital = current assets – current liabilities;

^{12}– Retained earnings (tax effect accounting) = retained earnings + (income tax expense + provision for taxation – future tax benefit).

Sample Size

There were a total of 1300 industrial companies in the FINSELECT (Financial Statistics on Listed Companies) database listed on Australian Stock Exchange during the period 1988 and 1998. Out of the 1300 companies, 287 companies were found to exist during 1988 through to 1997. Of the 287 companies, 26 companies did not have complete data sets. This left 261 companies that had met the four criteria. Out of this, 199 were randomly selected (Appendix 1). Using the guidelines proposed by Hair et al. (1995), the present study achieved at least six cases per ratio, which provided an adequate sample size for factor analysis.

Conclusion

Factor analysis was employed to empirically classify ratios used in prior Australian failure prediction studies. A total of thirty-one unique financial ratios were identified based on the models derived in prior Australian failure prediction studies. A random of

CHAPTER FIVE

Results

<u>Introduction</u>

The first part of this chapter presents the preliminary analyses of the financial ratios.

The second part reports on the results relating to the financial patterns of Australian

industrial firms. Finally, the extent of the stability of the financial patterns over time is

reported.

<u>Preliminary Analyses</u>

Factor analysis was used primarily as a tool for reducing the number of variables to a

smaller number of factors. Therefore, factor analysis was not susceptible to the

violation of the assumption of normality. However, by normalising the ratios, it would

enhance the solution extracted by improving linearity, reducing outliers, and

improving the homoscedasticity of the distributions (Hair et al., 1995). The thirty-one

ratios in all the three years (1989, 1993 and 1997) were assessed for normality and

linearity.

<u>Test for Normality and Linearity</u>

Distributions of the thirty-one ratios for the 1989 period were examined for normality.

Table 6 presents the descriptive statistics on their skewness, kurtosis and statistical test

of normality (a modification of the Kolmogorov-Smirnov test) (Tabachnick & Fidell,

Table 6

Distributions and Normality Test for 1989 Period

		Shape		Normality Test	
		Skewness	Kurtosis	Statistic	Significance
1	Quick ratio	6.764	57.277	0.368	0.000
2	Balance Sheet Decomposition Measure	2.973	9.942	0.305	0.000
3	Cash flow before tax/current liabilities	-11.513	147.346	0.393	0.000
4	Assets Decomposition Measure	2.608	7.159	0.249	0.000
5	Current assets/current liabilities	6.892	59.802	0.361	0.000
6	Current assets/total assets	0.337	-0.238	0.036	0.200
7	Current assets/total liabilities	7.902	76.535	0.382	0.000
8	Equities Decomposition Measure	-12.951	175.561	0.471	0.000
9	Current liabilities/total liabilities	-0.472	-0.855	0.113	0.000
10	Earnings before interest and tax/ interest payments	11.196	138.504	0.418	0.000
11	Returns on shareholders funds	-7.420	70.375	0.373	0.000
12	Earnings before interest and tax/ tangible total assets	-7.904	75.173	0.355	0.000
13	Earnings before interest and tax/ total assets	-9.143	97.924	0.358	0.000
14	Operating income/operating assets	-13.246	182.015	0.428	0.000
15	Funded debt (borrowings)/ shareholder funds	-0.934	19.188	0.403	0.000
16	Funds from operations/total liabilities	-11.744	150.810	0.422	0.000
17	Absolute value of income before tax, interest and depreciation/ current liabilities (exclude overdrafts)	-10.647	131.134	0.394	0.000
18	Cash/current assets	1.809	2.632	0.244	0.000
19	Liabilities Decomposition Measure	3.354	15.566	0.203	0.000
20	Market value of equity/total liabilities	10.211	122.739	0.381	0.000
21	Net profit after tax/shareholders funds	-8.042	91.072	0.392	0.000
22	Quick assets/current assets	-0.424	-0.859	0.117	0.000
23	Quick liabilities/current liabilities	-2.388	6.273	0.246	0.000
24	Retained earnings/total assets	-9.642	93.534	0.413	0.000
25	Shareholders funds/total liabilities	9.163	103.148	0.377	0.000
26	Taxation liability (benefit) assessed/ before tax profit (loss)	8.180	77.550	0.333	0.000
27	Total liabilities/total assets	11.895	157.207	0.325	0.000
28	Current liabilities (excluding overdrafts)/ (cash + market value of listed securities + net trade debtors)	8.440	78.972	0.449	0.000
29	Working capital/total assets	-12.518	169.690	0.331	0.000
30	Pretax operating income/interest expense	11.248	139.385	0.423	0.000
31	Current assets/retained earnings (adjusted to eliminate tax-effect accounting)	10.709	152.596	0.471	0.000

Table 7

Distributions and Normality Test for 1993 Period

		Shape		Normality Test	
		Skewness	Kurtosis	Statistic	Significance
1	Quick ratio	11.520	144.199	0.430	0.000
2	Balance Sheet Decomposition Measure	13.758	192.071	0.462	0.000
3	Cash flow before tax/current liabilities	4.979	52.342	0.302	0.000
4	Assets Decomposition Measure	4.522	27.353	0.262	0.000
5	Current assets/current liabilities	12.070	154.947	0.428	0.000
6	Current assets/total assets	0.529	-0.235	0.082	0.003
7	Current assets/total liabilities	12.087	155.164	0.438	0.000
8	Equities Decomposition Measure	-10.062	104.785	0.424	0.000
9	Current liabilities/total liabilities	-0.321	-1.057	0.106	0.000
10	Earnings before interest and tax/ interest payments	7.217	74.860	0.405	0.000
11	Returns on shareholders funds	14.069	198.280	0.491	0.000
12	Earnings before interest and tax/ tangible total assets	14.048	197.922	0.499	0.000
13	Earnings before interest and tax/ total assets	14.054	199.040	0.502	0.000
14	Operating income/operating assets	-5.758	112.410	0.462	0.000
15	Funded debt (borrowings)/ shareholder funds	3.843	37.240	0.382	0.000
16	Funds from operations/total liabilities	5.707	69.828	0.351	0.000
17	Absolute value of income before tax, interest and depreciation/ current liabilities (exclude overdrafts)	4.435	45.025	0.286	0.000
18	Cash/current assets	2.083	3.893	0.241	0.000
19	Liabilities Decomposition Measure	4.837	28.292	0.322	0.000
20	Market value of equity/total liabilities	13.756	192.145	0.456	0.000
21	Net profit after tax/shareholders funds	14.075	198.394	0.494	0.000
22	Quick assets/current assets	-0.467	-0.723	0.126	0.000
23	Quick liabilities/current liabilities	-4.565	25.059	0.321	0.000
24	Retained earnings/total assets	-13.722	191.487	0.453	0.000
25	Shareholders funds/total liabilities	10.484	114.316	0.431	0.000
26	Taxation liability (benefit) assessed/ before tax profit (loss)	-12.409	164.935	0.410	0.000
27	Total liabilities/total assets	12.161	160.763	0.393	0.000
28	Current liabilities (excluding overdrafts)/ (cash + market value of listed securities + net trade debtors)	14.104	198.942	0.495	0.000
29	Working capital/total assets	-12.672	171.039	0.394	0.000
30	Pretax operating income/interest expense	10.319	124.325	0.420	0.000
31	Current assets/retained earnings (adjusted to eliminate tax-effect accounting)	-9.316	96.990	0.408	0.000

Table 8

Distributions and Normality Test for 1997 Period

		Shape		Normality Test	
		Skewness	Kurtosis	Statistic	Significance
1	Quick ratio	7.040	52.476	0.417	0.000
2	Balance Sheet Decomposition Measure	8.577	84.102	0.387	0.000
3	Cash flow before tax/current liabilities	4.729	64.408	0.295	0.000
4	Assets Decomposition Measure	8.402	94.298	0.237	0.000
5	Current assets/current liabilities	7.006	52.078	0.420	0.000
6	Current assets/total assets	0.382	-0.558	0.059	0.090
7	Current assets/total liabilities	7.254	54.887	0.436	0.000
8	Equities Decomposition Measure	4.660	32.606	0.365	0.000
9	Current liabilities/total liabilities	-0.176	-1.119	0.094	0.000
10	Earnings before interest and tax/ interest payments	-11.534	153.396	0.462	0.000
11	Returns on shareholders funds	-2.673	11.357	0.240	0.000
12	Earnings before interest and tax/ tangible total assets	-7.921	82.182	0.294	0.000
13	Earnings before interest and tax/ total assets	-3.712	17.693	0.254	0.000
14	Operating income/operating assets	-6.324	66.462	0.298	0.000
15	Funded debt (borrowings)/ shareholder funds	5.133	34.995	0.333	0.000
16	Funds from operations/total liabilities	11.416	145.164	0.445	0.000
17	Absolute value of income before tax, interest and depreciation/ current liabilities (exclude overdrafts)	4.391	61.474	0.289	0.000
18	Cash/current assets	2.028	3.498	0.235	0.000
19	Liabilities Decomposition Measure	6.495	50.180	0.271	0.000
20	Market value of equity/total liabilities	8.251	74.871	0.428	0.000
21	Net profit after tax/shareholders funds	-3.194	14.483	0.278	0.000
22	Quick assets/current assets	-0.506	-0.669	0.116	0.000
23	Quick liabilities/current liabilities	-4.789	28.869	0.347	0.000
24	Retained earnings/total assets	-4.987	30.300	0.268	0.000
25	Shareholders funds/total liabilities	6.212	41.162	0.389	0.000
26	Taxation liability (benefit) assessed/ before tax profit (loss)	13.962	196.204	0.472	0.000
27	Total liabilities/total assets	2.190	10.448	0.146	0.000
28	Current liabilities (excluding overdrafts)/ (cash + market value of listed securities + net trade debtors)	9.343	92.741	0.398	0.000
29	Working capital/total assets	0.425	3.864	0.104	0.000
30	Pretax operating income/interest expense	-8.427	118.508	0.439	0.000
31	Current assets/retained earnings (adjusted to eliminate tax-effect accounting)	8.903	89.767	0.373	0.000

The skewness of the ratios also suggested that they departed significantly from linearity (Tabachnick & Fidell, 1996). Linearity between two ratios could be assessed roughly by inspection of the distribution (skewness). If the skewness values are nearest to zero for both ratios, it indicates that the relationship between the ratios is linear. With thirty-one ratios, the examination of all pair-wise scatter-plots (about 465 plots) was impractical (see Tabachnick & Fidell, 1996, for a similar argument). The descriptive statistics (Table 6) showed that the plot expected to be among the worst for the 1989 period was between ratio 27 ("total liabilities to total assets") (skewness = 11.895) and ratio 29 ("working capital to total assets") (skewness = -12.518). When plotted (Figure 2), the extreme skewness of the ratios suggested a departure from linearity.
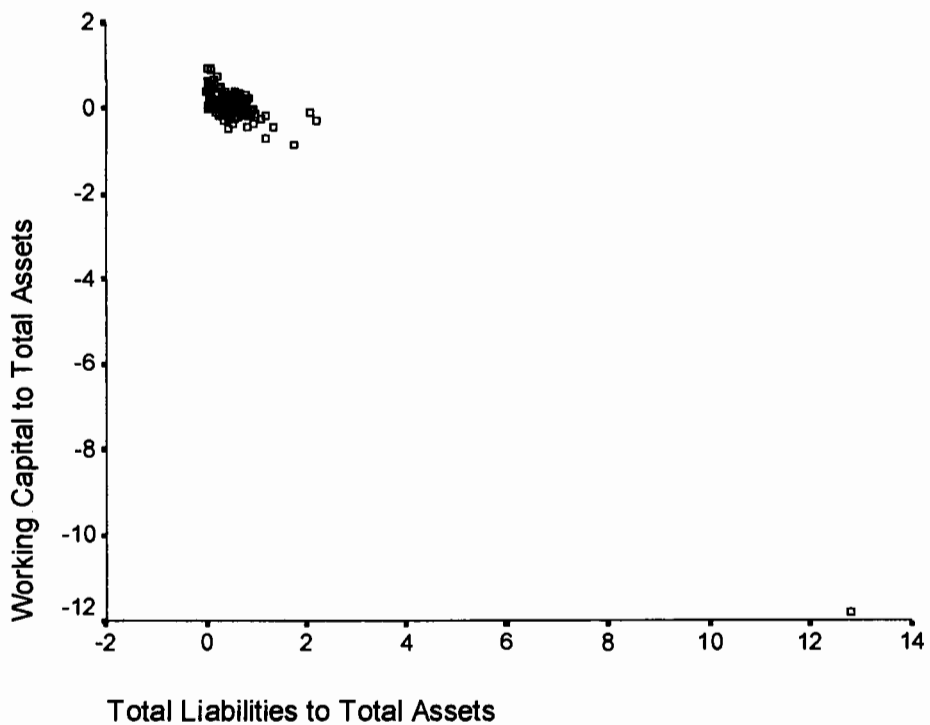
Figure 2. Spot-check for linearity among ratios through scatter-plot – Ratio 27 ("total liabilities to total assets") and Ratio 29 ("working capital to total assets")

A spot check for linearity on the thirty-one ratios was also performed for the 1993 period. Figure 3 shows the plot between ratio 21 ("net profit after tax to shareholders funds") (skewness = 14.075) and ratio 24 ("retained earnings to total assets") (with strong negative skewness·= -13.722), which suggested that they did not have a linear relation.

Figure 3. Spot-check for linearity among ratios through scatter-plot – Ratio 21 ("net profit after tax to shareholders funds") and Ratio 24 ("retained earnings to total assets")

The plot (Figure 4) that was expected to be among the worst was between ratio 16

("funds from operations to total liabilities") (skewness = 11.416) and ratio 12

("earnings before interest and tax to tangible total assets") (skewness = -7.921) for the

1997 period. The plot showed that the relation between these two ratios was non-

linear. This might be caused by the extreme skewness of the ratios.
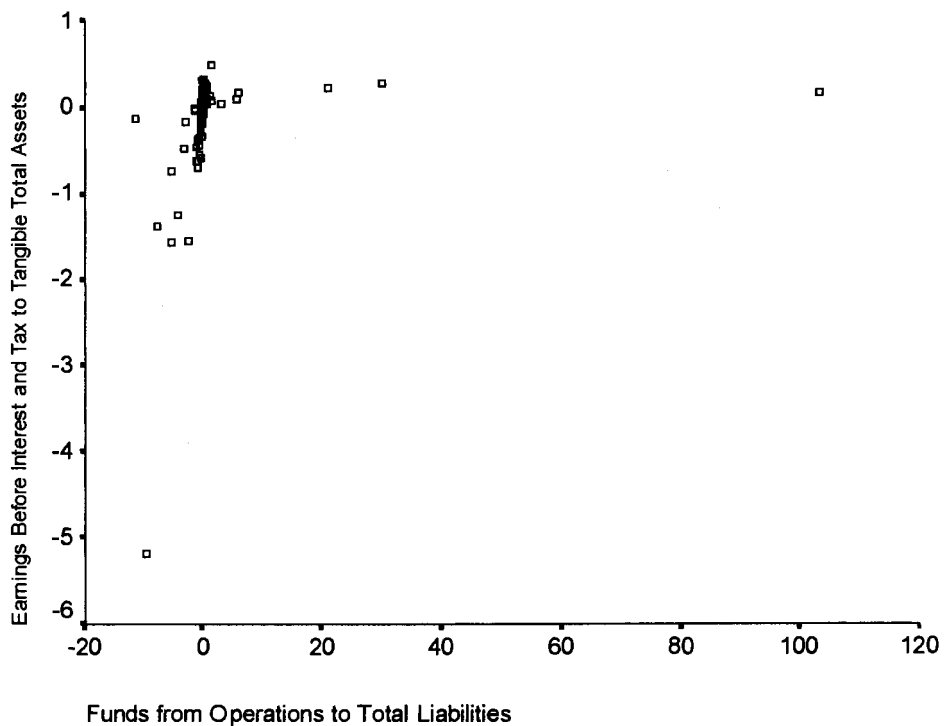
Figure 4. Spot-check for linearity among ratios through scatter-plot – Ratio 16
("funds from operations to total liabilities") and Ratio 12 ("earnings
before interest and tax to tangible total assets")

Remedies for Normality and Linearity

It could be observed from the above discussion that the distributions of all apart from one of the thirty-one ratios for all the three periods (1989, 1993 and 1997) departed severely from normal. Linearity was related to the assumption of normality because when one of the ratios was non-normal, then the scatter-plot between this ratio and another would not be linear (Tabachnick & Fidell, 1996). Since non-normality and the lack of linearity were detected, these could be improved by either transforming the data or normalising the data (e.g. the LISREL (LInear Structural RELations) program).[35] The later option was used to normalise all the ratios to produce skewness and kurtosis values that were nearest to zero. The LISREL program (Jöreskog & Sörbom, 1996; 1999) offered a distinctive feature called NORMAL SCORES to normalise non-normal variables.[36]

The formulae for the computation of the NORMAL SCORES is:

$$3 \times (i - 1) / (3 \times n + 1)$$

where

i = rank of each cases in ascending order
n = the number of cases

---

[35] Data transformations provided a means of modifying the ratios to correct the violation of the statistical assumptions underlying the multivariate techniques and to improve the relationship (correlation) between these ratios (Tabachnick & Fidell, 1996; Hair et al., 1995).

[36] NORMAL SCORES offered an effective way of normalising a continuous ratio for which the origin and unit of measurement had no intrinsic meaning (Jöreskog & Sörbom, 1996).

Subsequent to performing the NORMAL SCORES, the distributions (skewness and kurtosis) of all the ratios in all the three years (1989, 1993 and 1997) were close to zero values and had insignificant differences from normality (p = 0.200). However, with a total of 93 ratios in all the three years, graphical analyses of all the ratios were impractical. Therefore, a spot check of two ratios for each year was carried out.

Figure 5 and Figure 6 show the normal probability plots (for 1989) of ratio 27 ("total liabilities to total assets") and ratio 29 ("working capital to total assets"), respectively, after normalisation. Skewness for ratio 27 ("total liabilities to total assets") was reduced from 11.895 to 0.000, and kurtosis was reduced from 157.207 to –0.017 after NORMAL SCORES computation. Similarly, skewness for ratio 29 ("working capital to total assets") was reduced from –12.518 to 0.000 and kurtosis was reduced from 169.690 to –0.017. Both plots were fairly normally distributed.
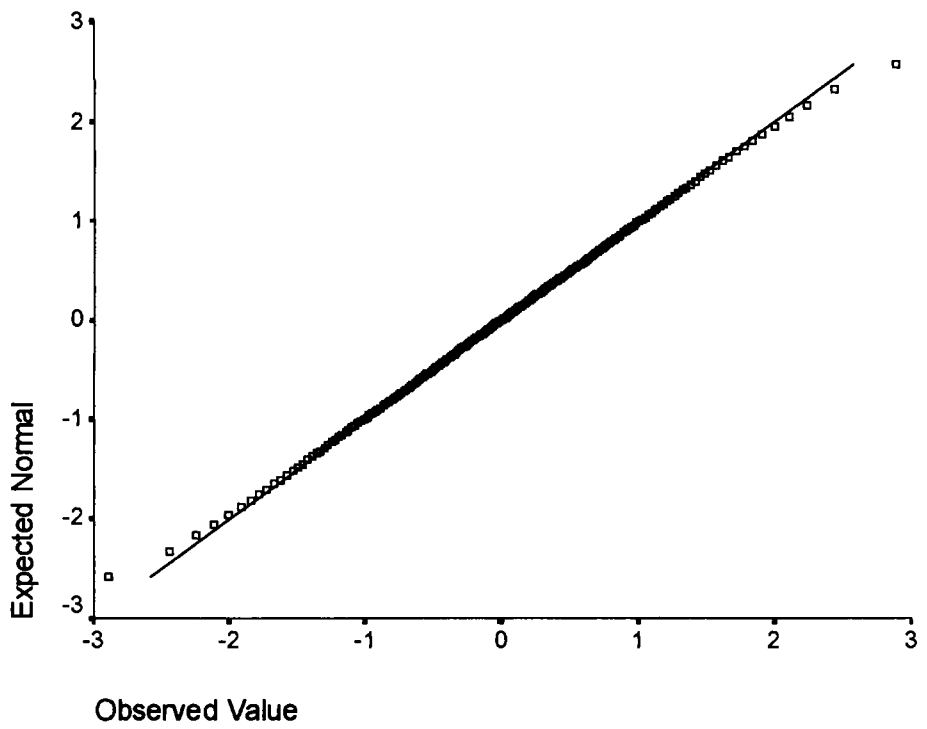
Figure 5. Normal probability plot for Ratio 27 ("total liabilities to total assets")
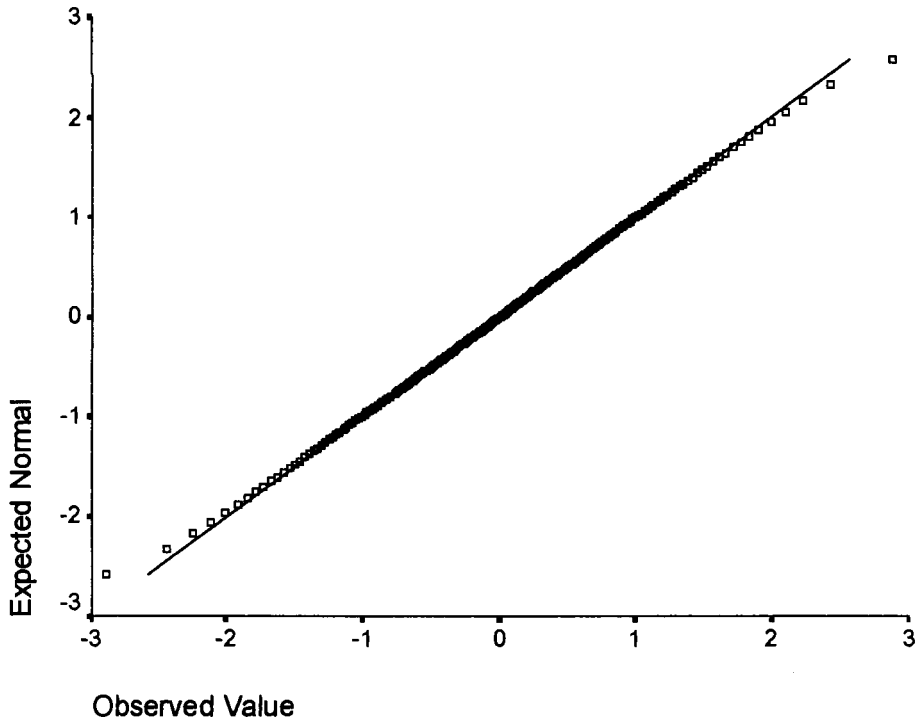
Figure 6. Normal probability plot for Ratio 29 ("working capital to total assets")

The bivariate scatter-plot between ratio 27 ("total liabilities to total assets") and ratio 29 ("working capital to total assets") for the 1989 period was examined for linearity (Figure 7). The overall shape was nearly oval, which suggested that the ratios were linearly related. This showed that the non-linearity that was associated with non-normality of the ratios was corrected by normalising the ratios.
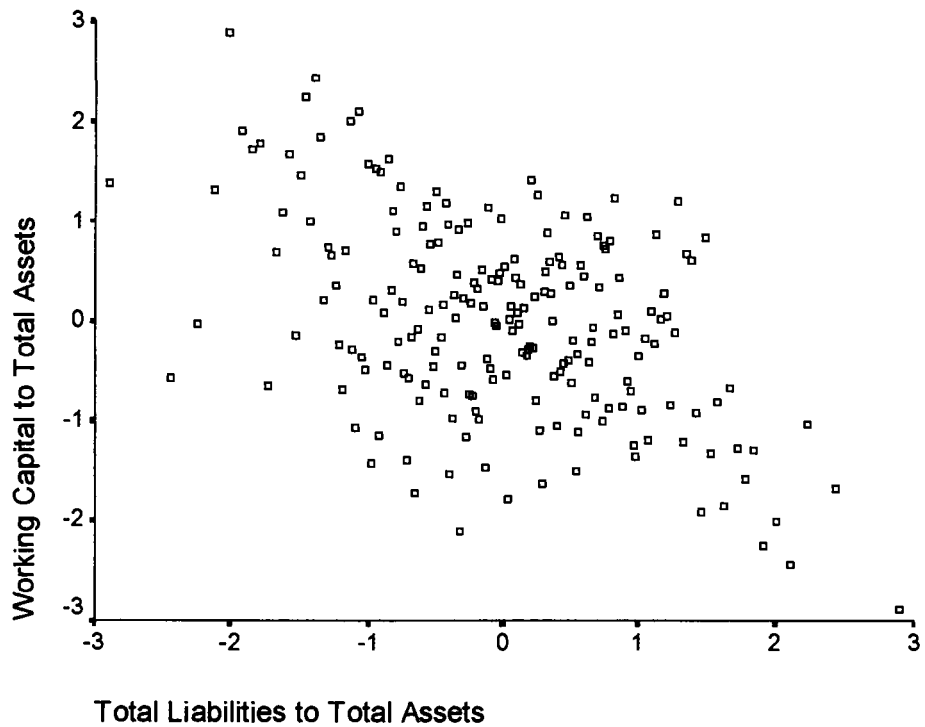
Figure 7. Assessment of linearity after normalisation for Ratio 29 ("working capital to total assets") and Ratio 27 ("total liabilities to total assets")

Ratio 21 ("net profit after tax to shareholders funds") and ratio 24 ("retained earnings to total assets") in the 1993 period had the greatest departure from normality (Table 7). Skewness for ratio 21 ("net profit after tax to shareholders funds") was reduced from 14.075 to 0.000 and kurtosis was reduced from 198.394 to –0.017. Meanwhile, skewness for ratio 24 ("retained profits to total assets") was reduced from –13.722 to 0.000, and kurtosis was reduced from 191.487 to –0.017. The plots (Figures 8 and 9) showed near normal distribution.
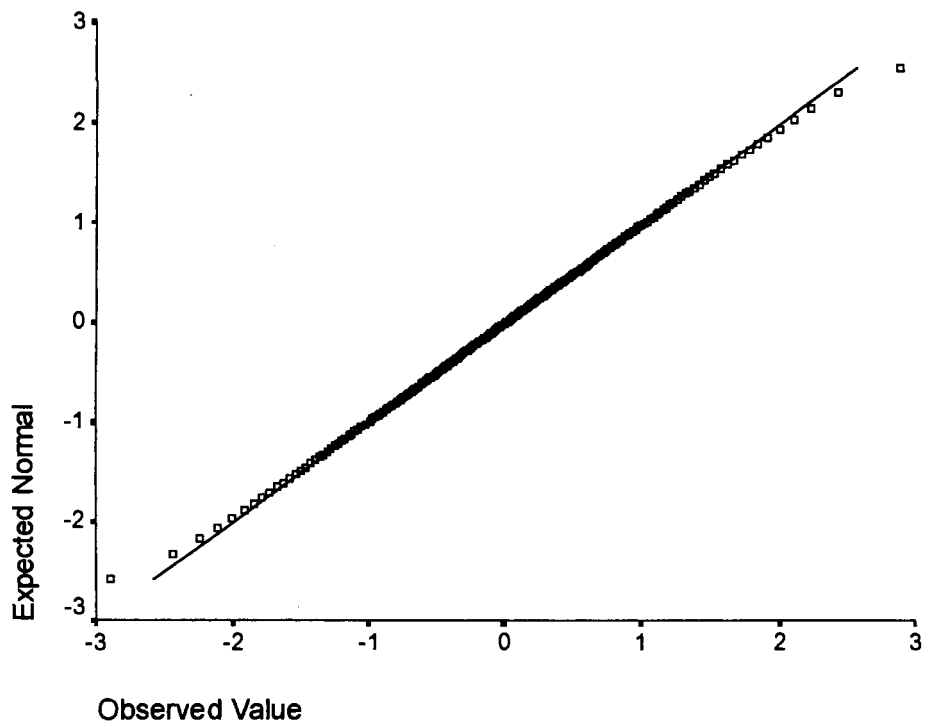
Figure 8. Normal probability plot for Ratio 21 ("net profit after tax to shareholders
        funds")
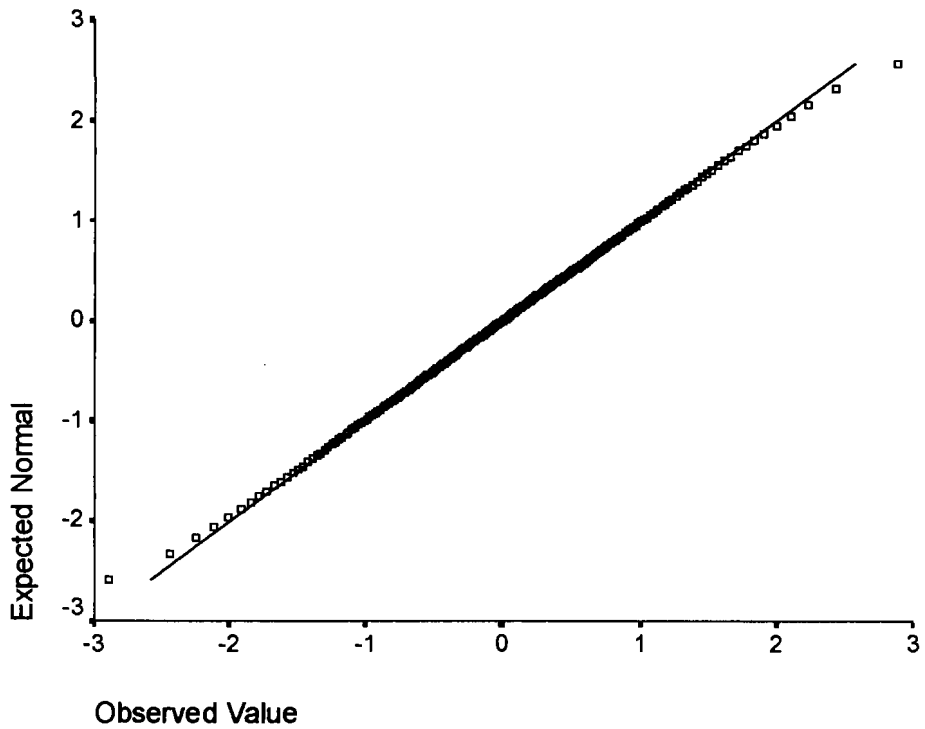
Figure 9. Normal probability plot for Ratio 24 ("retained earnings to total assets")

Figure 10 is a bivariate scatter-plot (for 1993) between ratio 21 ("net profit after tax to shareholders funds") and ratio 24 ("retained earnings to total assets"). Although, the shape of the scatter-plot was not perfect, the overall shape was much improved relative to the one shown in Figure 3.
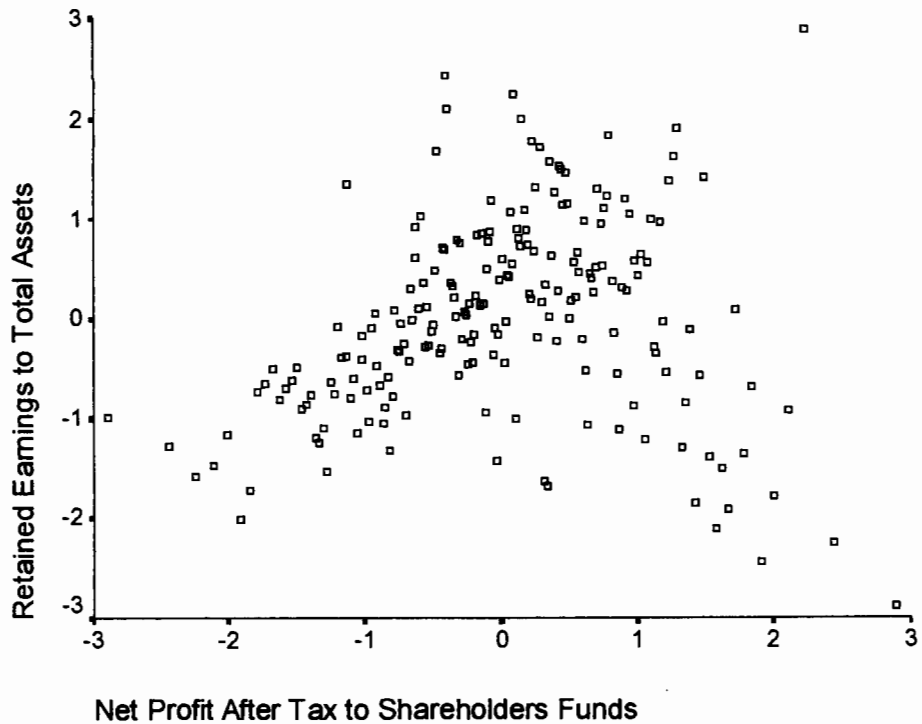
Figure 10. Assessment of linearity after normalisation for Ratio 21 ("net profit after tax to shareholders funds") and Ratio 24 ("retained earnings to total assets")

Figure 11 and Figure 12 show the distributions for ratio 16 ("funds from operations to total liabilities") and ratio 12 ("earnings before interest and tax to tangible total assets") respectively for 1997. The plots showed that the ratios were normally distributed. Figure 13 is a bivariate scatter-plot between ratio 16 ("funds from operations to total liabilities") and ratio 12 ("earnings before interest and tax to tangible total assets"). The overall shape of the scatter-plot was nearly oval. The non-linearity associated with non-normality of the ratios was corrected after normalisation.
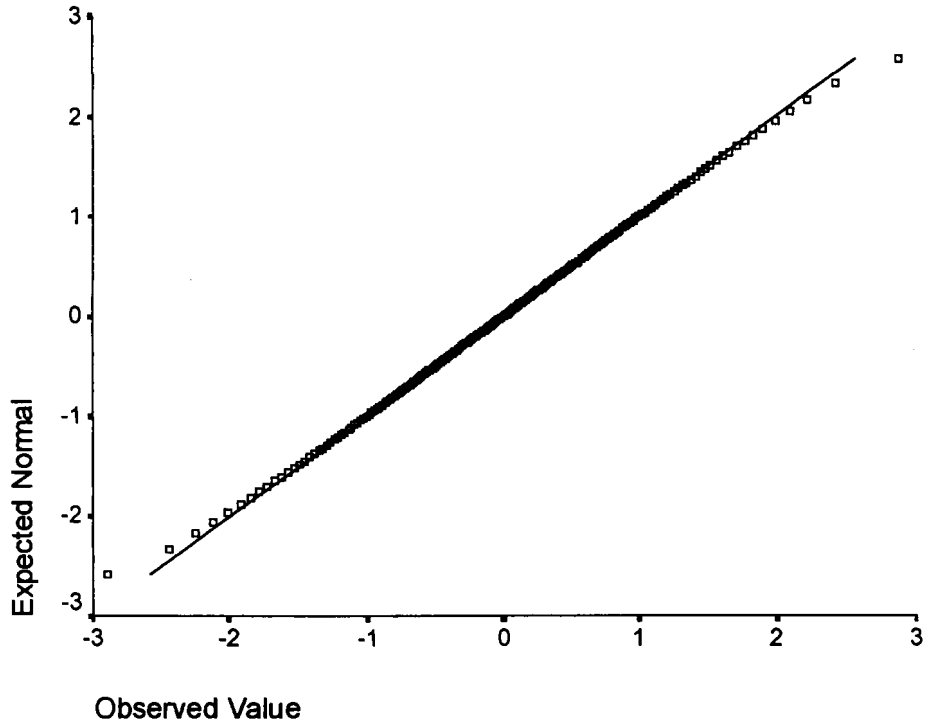
Figure 11. Normal probability plot for Ratio 16 ("funds from operations to total liabilities")
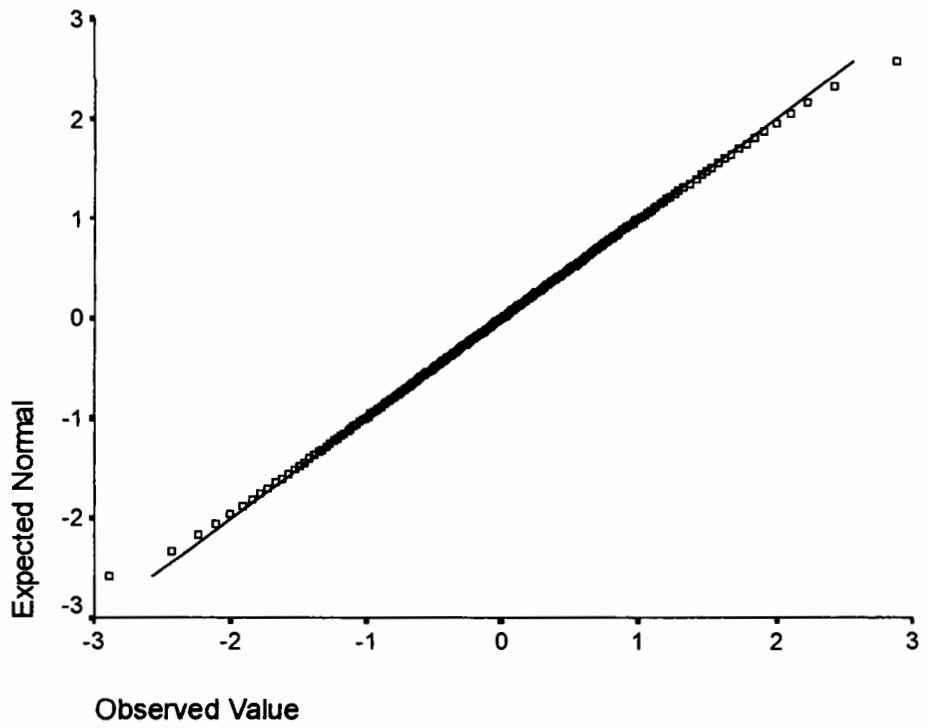
Figure 12. Normal probability plot for Ratio 12 ("earnings before interest and tax to tangible total assets")
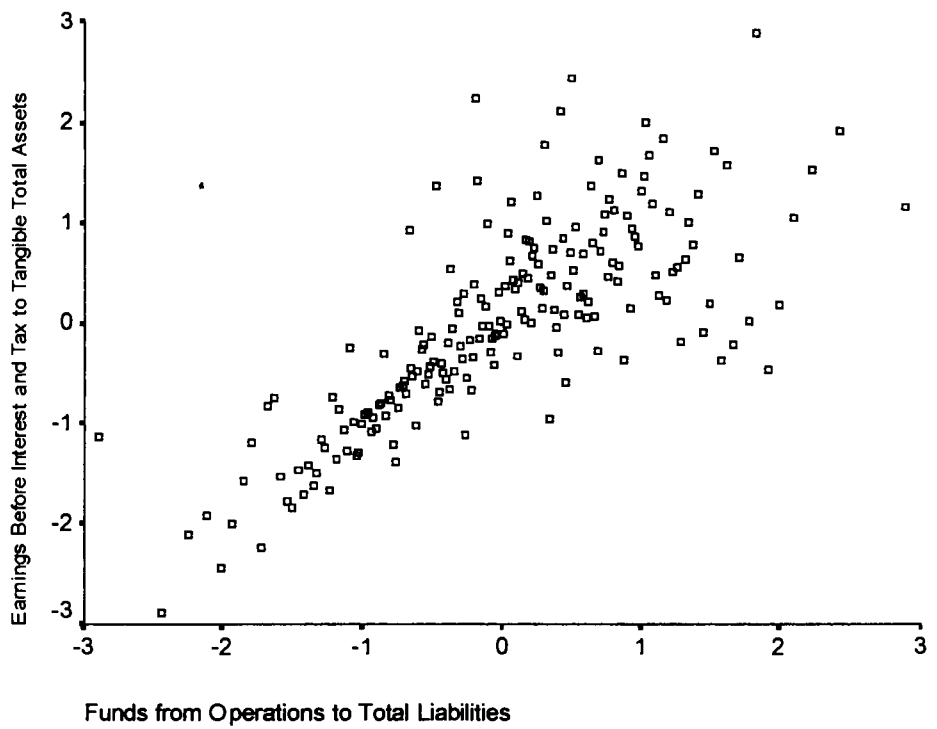
Figure 13. Assessment of linearity after normalisation for Ratio 16 ("funds from operations to total liabilities") and Ratio 12 ("earnings before interest and tax to tangible total assets")

Examining the Correlation Matrix

The specific goal of factor analysis was to summarise patterns of correlations among observed variables (or ratios), and group these variables into a few factors (Tabachnick & Fidell, 1996; Hair et al., 1995). Therefore, it was necessary to ensure that the data matrix had sufficient correlations to justify the application of factor analysis. Two tests (correlations of the data matrix and anti-image correlation matrix) were applied to justify the application of factor analysis. Correlation matrices between the thirty-one ratios for the 1989 period was produced by SPSS Program (Statistical Package for the Social Sciences) (Norušis/SPSS Inc, 1994). They revealed numerous correlations with r in excess of 0.300 (Tabachnick & Fidell, 1996; Hair et al., 1995) in absolute value (Table 9). Another indication of the strength of the relationship among the ratios was the anti-image correlation.[37] The matrix of the anti-image correlation is shown in Table 10. The proportion of the high correlation coefficients was small indicating that the data matrix was suited to factor analysis. These two measures indicated that the set of thirty-one ratios for the 1989 period was appropriate for factor analysis.

---

[37] The negative of the partial correlation coefficient is called the anti-image correlation.

Table 9

Intercorrelations Matrices of Thirty-One Ratios for the 1989 Period

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Quick Ratio	1.000																														
2	Balance Sheet Decomposition Measure	0.048	1.000																													
3	Cash Flow Before Tax/Current Liabilities	0.283	-0.154	1.000																												
4	Assets Decomposition Meas.	0.240	0.399	-0.135	1.000																											
5	Current Assets/Current Liab.	0.796	-0.033	0.337	0.135	1.000																										
6	Current Assets/Total Assets	0.234	-0.048	0.133	0.083	0.465	1.000																									
7	Current Assets/Total Liabilities	0.601	0.002	0.221	0.170	0.828	0.638	1.000																								
8	Equities Decomposition Meas.	0.162	-0.079	0.151	-0.042	0.172	0.186	0.125	1.000																							
9	Current Liabilities/Total Liabilities	-0.055	0.077	-0.128	0.110	0.039	0.358	0.511	-0.116	1.000																						
10	Earnings Before Interest and Tax/Interest Payments	0.103	-0.201	0.706	-0.133	0.242	0.239	0.239	0.165	-0.003	1.000																					
11	Returns on Shareholders Funds	-0.142	-0.165	0.413	-0.224	-0.057	0.211	-0.078	0.234	-0.173	0.472	1.000																				
12	Earnings Before Interest and Tax/Tangible Total Assets	0.007	-0.187	0.704	-0.225	0.127	0.244	0.140	0.256	-0.062	0.687	0.649	1.000																			
13	Earnings Before Interest and Tax/Total Assets	0.037	-0.202	0.735	-0.239	0.179	0.296	0.197	0.251	-0.023	0.713	0.664	0.959	1.000																		
14	Operating Income/Operating Assets	0.086	-0.208	0.828	-0.195	0.145	0.018	0.072	0.184	-0.131	0.696	0.494	0.808	0.810	1.000																	
15	Funded Debt (Borrowings)/Shareholders Funds	-0.060	-0.039	0.069	-0.064	-0.044	-0.066	-0.177	0.084	-0.317	0.061	0.085	0.122	0.104	0.135	1.000																
16	Funds From Operations/Total Liabilities	0.254	-0.140	0.919	-0.108	0.327	0.240	0.357	0.146	0.096	0.711	0.423	0.710	0.745	0.774	0.020	1.000															
17	Absolute Value of Income Before Tax, Interest & Depreciation/Current Liabilities	0.325	-0.004	0.298	-0.014	0.298	-0.306	0.111	-0.042	-0.073	0.167	0.013	0.099	0.121	0.233	-0.131	0.214	1.000														
18	Cash/Current Assets	0.339	0.135	0.049	0.182	0.253	0.022	0.142	0.091	-0.076	-0.075	-0.092	-0.092	-0.112	-0.021	-0.019	0.008	0.065	1.000													
19	Liabilities Decomposition Measure	0.035	0.175	-0.114	0.197	0.020	0.134	0.096	0.061	0.137	-0.070	-0.135	-0.108	-0.103	-0.161	-0.131	-0.054	-0.082	-0.002	1.000												
20	Market Value of Equity/Total Liabilities	0.393	-0.027	0.281	0.121	0.476	0.101	0.544	-0.068	0.415	0.166	-0.227	0.056	0.113	0.212	-0.210	0.334	0.407	0.102	0.003	1.000											
21	Net Profit After Tax/Shareholders Funds	-0.082	-0.096	0.486	-0.217	0.010	0.257	0.034	0.175	-0.051	0.503	0.870	0.666	0.691	0.537	-0.132	0.504	0.065	-0.085	-0.059	-0.085	1.000										
22	Quick Assets/Current Assets	0.480	0.134	0.030	0.197	0.003	-0.186	-0.060	-0.010	-0.051	-0.196	-0.080	-0.151	-0.179	-0.069	-0.040	0.018	0.076	0.424	0.014	0.041	-0.067	1.000									
23	Quick Liabilities/Current Lia.	0.017	0.009	0.088	0.072	0.181	0.212	0.251	0.018	0.188	0.069	0.021	0.068	0.072	0.142	-0.029	0.086	-0.084	0.329	0.001	0.176	0.080	0.113	1.000								
24	Retained Earnings/Total Assets	0.238	-0.266	0.613	-0.187	0.333	0.273	0.329	0.158	-0.003	0.566	0.413	0.622	0.675	0.599	0.114	0.648	0.083	-0.120	-0.091	0.186	0.435	-0.088	-0.017	1.000							
25	Shareholders Funds/Total Liab.	0.498	0.001	0.215	0.109	0.509	-0.185	0.550	-0.069	0.338	0.106	-0.395	-0.042	-0.016	0.120	-0.182	0.262	0.500	0.091	-0.005	0.704	-0.256	0.155	0.111	0.196	1.000						
26	Taxation Liability (benefit) Assessed/Bef Tax Profit	-0.059	-0.152	0.252	-0.118	0.012	0.100	0.014	0.146	-0.078	0.276	0.277	0.293	0.298	0.320	0.123	0.179	-0.022	-0.188	-0.149	-0.087	0.155	-0.168	0.065	0.276	-0.131	1.000					
27	Total Liabilities/Total Assets	-0.498	-0.001	-0.215	-0.109	-0.509	0.185	-0.550	0.069	-0.338	-0.106	0.395	0.042	0.016	-0.120	0.182	-0.262	-0.500	-0.091	0.005	-0.704	0.256	-0.155	-0.111	-0.196	-1.000	0.131	1.000				
28	Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	-0.619	-0.087	-0.156	-0.170	-0.427	0.055	-0.259	-0.053	0.082	0.003	0.175	0.108	0.094	-0.002	0.070	-0.120	-0.399	-0.327	0.086	-0.278	0.128	-0.346	0.008	-0.059	-0.399	0.061	0.399	1.000			
29	Working Capital/Total Assets	0.707	-0.047	0.323	0.132	0.927	0.552	0.816	0.181	0.095	0.291	-0.010	0.187	0.247	0.142	0.011	0.356	0.254	0.126	0.023	0.470	0.023	-0.056	0.174	0.408	0.482	0.036	-0.483	-0.347	1.000		
30	Pretax Operating Income/Interest Expense	0.103	-0.201	0.686	-0.115	0.239	0.208	0.245	0.145	0.016	0.974	0.470	0.649	0.679	0.676	0.023	0.695	0.197	-0.061	-0.059	0.206	0.506	-0.187	0.078	0.565	0.139	0.263	-0.139	-0.024	0.273	1.000	
31	Current Assets/Retained Earnings (Adjusted to eliminate tax-effect accounting)	0.017	-0.060	0.303	-0.156	0.127	0.092	0.090	0.017	-0.077	0.358	0.252	0.263	0.280	0.294	0.074	0.313	0.054	-0.160	-0.016	0.051	0.273	-0.163	0.003	0.306	0.008	0.128	-0.008	0.074	0.171	0.349	1.000

Table 10

<u>Anti-image Matrices of Thirty-One Ratios for the 1989 Period</u>

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Quick Ratio	0.719																														
2	Balance Sheet Decomposition Measure	-0.002	0.674																													
3	Cash Flow Before Tax/Current Liabilities	-0.005	-0.066	0.805																												
4	Assets Decomposition Meas.	-0.110	-0.344	-0.011	0.785																											
5	Current Assets/Current Liab.	-0.431	0.069	-0.346	0.123	0.734																										
6	Current Assets/Total Assets	-0.026	0.153	-0.263	-0.001	0.228	0.659																									
7	Current Assets/Total Liabilities	-0.108	-0.073	0.375	-0.080	-0.606	-0.469	0.751																								
8	Equities Decomposition Meas.	-0.109	0.034	0.033	0.049	0.062	-0.027	-0.022	0.833																							
9	Current Liabilities/Total Liabilities	0.131	-0.087	0.147	0.038	0.315	-0.322	-0.452	0.057	0.634																						
10	Earnings Before Interest and Tax/Interest Payments	-0.039	-0.018	0.005	0.033	-0.039	-0.120	0.010	-0.020	-0.030	0.825																					
11	Returns on Shareholders Funds	0.116	0.165	0.114	-0.075	0.009	0.232	-0.070	-0.123	-0.053	0.072	0.790																				
12	Earnings Before Interest and Tax/Tangible Total Assets	0.067	-0.018	0.079	-0.027	0.027	-0.047	-0.056	-0.033	0.119	-0.039	-0.013	0.873																			
13	Earnings Before Interest and Tax/Total Assets	-0.039	-0.017	-0.110	0.085	0.083	-0.013	-0.021	-0.025	-0.063	-0.079	-0.069	-0.797	0.877																		
14	Operating Income/Operating Assets	-0.198	0.065	-0.183	-0.056	-0.040	0.123	0.105	-0.052	-0.046	-0.051	0.037	-0.220	-0.090	0.916																	
15	Funded Debt (Borrowings)/Shareholders Funds	0.080	-0.089	0.004	0.027	-0.028	0.058	-0.013	-0.008	0.079	-0.057	-0.213	-0.003	-0.029	-0.123	0.590																
16	Funds From Operations/Total Liabilities	0.101	0.028	-0.825	0.018	0.285	0.197	-0.381	0.002	-0.110	-0.067	-0.090	-0.034	0.037	-0.090	0.013	0.814															
17	Absolute Value of Income Before Tax, Interest & Depreciation/Current Liabilities	-0.044	-0.025	-0.141	0.030	-0.072	0.184	0.163	0.077	-0.175	0.024	-0.120	0.004	-0.046	0.012	0.086	0.126	0.831														
18	Cash/Current Assets	0.155	-0.083	-0.013	-0.022	-0.234	0.031	-0.056	-0.106	0.047	0.027	-0.030	-0.044	0.027	-0.030	0.036	0.018	-0.028	0.676													
19	Liabilities Decomposition Measure	-0.060	-0.095	0.080	-0.119	-0.026	-0.083	0.048	-0.124	0.004	0.069	0.115	0.008	-0.022	0.066	0.047	-0.103	-0.051	0.029	0.659												
20	Market Value of Equity/Total Liabilities	0.022	0.050	0.019	-0.072	-0.074	-0.157	0.136	0.058	-0.192	0.189	0.045	0.140	-0.110	-0.198	0.043	-0.045	-0.118	-0.052	0.046	0.911											
21	Net Profit After Tax/Shareholders Funds	0.024	-0.193	-0.047	0.102	-0.097	-0.171	-0.004	0.054	0.072	0.039	-0.747	0.012	-0.101	-0.049	0.377	0.030	-0.059	0.133	-0.050	-0.005	0.779										
22	Quick Assets/Current Assets	-0.806	-0.001	-0.019	0.011	0.349	-0.002	0.159	0.086	-0.110	0.015	-0.168	-0.077	0.092	0.197	-0.072	-0.131	0.088	-0.310	0.023	0.029	-0.035	0.427									
23	Quick Liabilities/Current Liabilities	0.444	0.035	-0.058	-0.038	-0.110	-0.063	-0.078	0.016	0.050	0.043	-0.083	0.071	-0.005	-0.302	-0.016	0.166	0.123	-0.224	-0.029	0.017	-0.110	-0.389	0.414								
24	Retained Earnings/Total Assets	-0.040	0.136	0.030	0.057	0.064	-0.086	0.027	0.083	0.055	0.156	-0.025	0.111	-0.210	-0.103	-0.089	-0.086	0.201	0.087	-0.002	0.123	-0.058	-0.018	0.172	0.927							
25	Shareholders Funds/Total Liab.	-0.063	-0.019	-0.011	0.043	-0.015	-0.022	0.025	0.062	-0.030	-0.068	-0.144	0.012	-0.062	0.106	-0.069	-0.014	-0.038	-0.052	-0.093	-0.023	0.125	0.069	-0.048	0.046	0.765						
26	Taxation Liability (benefit) Assessed/Bef Tax Profit	-0.009	-0.006	-0.243	0.021	0.101	0.083	-0.198	-0.067	-0.004	-0.025	-0.214	-0.005	0.027	-0.129	0.070	0.260	-0.026	0.206	0.058	0.031	0.264	0.017	-0.113	-0.139	-0.011	0.695					
27	Total Liabilities/Total Assets	-0.063	-0.018	-0.010	0.043	-0.016	-0.024	0.026	0.062	-0.030	-0.068	-0.145	0.012	-0.062	0.106	-0.069	-0.015	-0.004	-0.052	-0.009	-0.023	0.126	0.069	-0.047	0.047	1.000	-0.011	0.765				
28	Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	0.346	0.056	-0.066	0.010	-0.034	0.066	-0.113	0.027	0.008	-0.094	-0.036	-0.009	-0.026	-0.095	0.022	0.134	0.185	0.172	-0.153	-0.033	0.048	-0.153	0.067	0.015	0.050	0.084	0.049	0.839			
29	Working Capital/Total Assets	-0.009	-0.113	0.256	-0.077	-0.557	-0.527	0.239	-0.034	0.204	-0.009	-0.217	0.018	-0.103	0.168	-0.109	-0.232	-0.156	0.179	0.066	-0.029	0.251	0.029	-0.131	-0.125	0.093	-0.004	0.094	-0.048	0.784		
30	Pretax Operating Income/Interest Expense	0.017	0.052	-0.035	-0.062	0.071	0.102	-0.097	0.030	0.027	-0.944	-0.010	0.034	0.071	0.015	0.062	0.045	-0.029	-0.056	-0.081	-0.164	-0.046	0.047	-0.044	-0.157	0.054	0.070	0.053	0.095	-0.009	0.821	
31	Current Assets/Retained Earnings (Adjusted to eliminate tax-effect accounting)	-0.019	-0.074	0.009	0.116	0.033	0.085	-0.033	0.062	0.025	-0.075	-0.003	0.011	0.072	-0.031	-0.044	-0.055	0.022	0.081	-0.041	-0.044	-0.077	0.045	-0.028	-0.071	0.110	-0.005	0.110	-0.050	-0.097	0.023	0.907

67

Correlation matrices between the thirty-one ratios for 1993, which are shown in Table 11, also revealed numerous correlations with r greater than 0.300 in absolute value. When the anti-image correlation matrix was examined (Table 12), it revealed a high proportion of intercorrelations that were fairly small. This provided an adequate basis for proceeding with factor analysis.

A similar test was also performed for the 1997 data. Table 13 shows that the intercorrelations among the thirty-one ratios. It revealed that the proportion of correlations with r greater than 0.300 (in absolute value) was adequate. In addition, the anti-image correlation matrix (Table 14) also showed that the proportion of high correlation coefficients were low.[38] This confirmed the appropriateness of factor analysis on this data set.

---

[38] The anti-image matrices showed only thirty ratios, deleting ratio 25 because ratios 25 and 27 were negatively correlated. However, ratio 25 was included in the factor analysis.

Table 11

Intercorrelations Matrices of Thirty-One ratios for the 1993 Period

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Quick Ratio	1.000																														
2	Balance Sheet Decomposition Measure	-0.125	1.000																													
3	Cash Flow Before Tax/Current Liabilities	0.212	-0.201	1.000																												
4	Assets Decomposition Meas.	0.117	0.187	-0.078	1.000																											
5	Current Assets/Current Liab.	0.874	-0.153	0.167	0.108	1.000																										
6	Current Assets/Total Assets	0.254	0.050	-0.084	0.153	0.384	1.000																									
7	Current Assets/Total Liabilities	0.721	-0.142	0.132	0.099	0.840	0.602	1.000																								
8	Equities Decomposition Meas.	0.071	0.026	0.202	-0.095	0.044	-0.031	0.023	1.000																							
9	Current Liabilities/Total Liabilities	0.136	0.054	-0.123	0.140	0.174	0.462	0.592	-0.165	1.000																						
10	Earnings Before Interest and Tax/Interest Payments	0.198	-0.205	0.682	-0.202	0.199	0.102	0.244	0.257	-0.038	1.000																					
11	Returns on Shareholders Funds	-0.099	0.042	0.454	-0.132	-0.194	0.034	-0.153	0.151	-0.097	0.426	1.000																				
12	Earnings Before Interest and Tax/Tangible Total Assets	0.170	-0.161	0.770	-0.112	0.087	0.081	0.125	0.218	-0.119	0.704	0.645	1.000																			
13	Earnings Before Interest and Tax/Total Assets	0.181	-0.162	0.771	-0.120	0.111	0.129	0.160	0.217	-0.089	0.712	0.664	0.970	1.000																		
14	Operating Income/Operating Assets	0.154	-0.229	0.844	-0.120	0.080	-0.058	0.082	0.176	-0.193	0.695	0.514	0.879	0.875	1.000																	
15	Funded Debt (Borrowings)/Shareholders Funds	-0.081	0.003	-0.059	-0.134	-0.063	-0.031	-0.137	0.098	-0.235	-0.035	0.035	0.031	0.013	0.003	1.000																
16	Funds From Operations/Total Liabilities	0.258	-0.190	0.889	-0.108	0.229	0.009	0.291	0.263	0.053	0.700	0.429	0.749	0.758	0.763	-0.102	1.000															
17	Absolute Value of Income Before Tax, Interest & Depreciation/Current Liabilities	0.512	-0.087	0.363	0.153	0.441	-0.203	0.296	-0.015	-0.009	0.124	0.094	0.216	0.223	0.309	-0.187	0.307	1.000														
18	Cash/Current Assets	0.291	0.122	-0.033	0.178	0.194	-0.001	0.210	-0.076	0.266	0.021	0.018	-0.042	-0.033	-0.026	-0.176	-0.004	0.231	1.000													
19	Liabilities Decomposition Measure	0.071	0.113	0.120	0.121	0.025	0.116	0.099	0.041	0.170	0.143	0.199	0.183	0.159	0.099	-0.092	0.136	-0.012	0.125	1.000												
20	Market Value of Equity/Total Liabilities	0.502	-0.205	0.306	-0.002	0.530	0.033	0.579	0.013	0.320	0.265	-0.029	0.216	0.247	0.299	-0.212	0.382	0.583	0.332	-0.021	1.000											
21	Net Profit After Tax/Shareholders Funds	-0.090	0.011	0.488	-0.104	-0.170	-0.025	-0.129	0.009	-0.028	0.449	0.801	0.556	0.567	0.499	-0.300	0.472	0.144	0.115	0.139	0.067	1.000										
22	Quick Assets/Current Assets	0.382	0.138	0.012	0.173	0.051	-0.168	0.009	-0.065	0.154	-0.131	0.047	-0.066	-0.074	-0.072	-0.103	-0.009	0.256	0.466	0.142	0.096	0.085	1.000									
23	Quick Liabilities/Current Liabilities	0.172	-0.054	0.100	0.005	0.168	0.029	0.223	-0.120	0.205	0.052	0.013	-0.014	-0.010	0.061	0.043	0.099	0.125	0.396	-0.010	0.225	0.036	0.278	1.000								
24	Retained Earnings/Total Assets	0.278	-0.271	0.514	-0.148	0.314	0.044	0.284	0.337	-0.085	0.550	0.194	0.409	0.463	0.443	0.004	0.506	0.190	-0.092	0.023	0.371	0.161	-0.067	0.061	1.000							
25	Shareholders Funds/Total Liab.	0.686	-0.229	0.291	0.020	0.737	0.027	0.738	0.071	0.289	0.277	-0.209	0.184	0.194	0.291	-0.202	0.401	0.552	0.256	0.022	0.744	-0.099	0.100	0.199	0.350	1.000						
26	Taxation Liability (benefit) Assessed/Bef Tax Profit	-0.009	-0.176	0.242	-0.187	-0.009	0.023	0.017	0.093	-0.102	0.290	0.221	0.278	0.298	0.231	0.058	0.196	0.070	-0.141	-0.057	0.094	0.103	-0.067	0.072	0.402	0.014	1.000					
27	Total Liabilities/Total Assets	-0.607	0.183	-0.280	-0.021	-0.658	-0.077	-0.657	-0.071	-0.213	-0.319	0.138	-0.252	-0.262	-0.358	0.219	-0.387	-0.477	-0.232	-0.004	-0.683	0.028	-0.027	-0.124	-0.288	-0.949	-0.005	1.000				
28	Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	-0.581	0.079	-0.169	-0.070	-0.537	-0.154	-0.435	0.008	-0.029	-0.216	-0.054	-0.174	-0.176	-0.193	0.193	-0.189	-0.356	-0.378	-0.053	-0.354	-0.100	-0.218	-0.045	-0.157	-0.482	0.005	-0.526	1.000			
29	Working Capital/Total Assets	0.679	-0.154	0.123	0.107	0.837	0.632	0.796	0.035	0.210	0.276	-0.054	0.206	0.249	0.163	-0.072	0.219	0.259	0.108	0.037	0.440	-0.067	-0.115	0.085	0.279	0.619	0.061	-0.675	-0.538	1.000		
30	Pretax Operating Income/Interest Expense	0.138	-0.196	0.512	-0.237	0.160	0.136	0.192	0.295	-0.068	0.794	0.351	0.534	0.545	0.530	-0.033	0.527	0.068	0.047	0.072	0.525	0.355	-0.117	0.011	0.614	0.187	0.301	-0.188	-0.163	0.217	1.000	
31	Current Assets/Retained Earnings (Adjusted to eliminate tax-effect accounting)	0.020	-0.155	0.183	-0.169	0.022	0.000	0.005	0.248	-0.118	0.270	0.200	0.198	0.217	0.205	-0.015	0.131	0.031	-0.030	-0.064	0.072	0.206	-0.045	-0.025	0.356	0.020	0.278	-0.019	-0.032	0.060	0.376	1.000

69

Table 12

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Quick Ratio	0.794																														
2	Balance Sheet Decomposition Measure	0.117	0.658																													
3	Cash Flow Before Tax/Current Liabilities	0.133	0.017	0.826																												
4	Assets Decomposition Meas.	0.077	-0.084	-0.052	0.723																											
5	Current Assets/Current Liab.	-0.546	-0.197	-0.331	-0.037	0.741																										
6	Current Assets/Total Assets	-0.036	-0.062	-0.121	-0.053	0.173	0.539																									
7	Current Assets/Total Liabilities	-0.174	-0.044	0.207	0.007	-0.302	-0.610	0.754																								
8	Equities Decomposition Meas.	-0.061	-0.106	0.053	-0.003	0.065	-0.050	-0.034	0.676																							
9	Current Liabilities/Total Liabilities	0.198	-0.010	-0.116	-0.041	0.370	-0.092	-0.567	0.159	0.613																						
10	Earnings Before Interest and Tax/Interest Payments	-0.072	0.041	-0.126	0.013	-0.006	0.289	-0.203	-0.031	-0.071	0.846																					
11	Returns on Shareholders Funds	0.001	-0.039	0.051	0.046	0.026	0.136	-0.071	-0.219	-0.080	0.143	0.748																				
12	Earnings Before Interest and Tax/Tangible Total Assets	-0.074	0.039	-0.013	-0.091	0.065	0.061	-0.051	-0.065	0.034	0.020	0.036	0.860																			
13	Earnings Before Interest and Tax/Total Assets	-0.020	-0.051	0.040	0.086	0.056	-0.026	-0.011	0.069	-0.022	-0.084	-0.247	-0.798	0.839																		
14	Operating Income/Operating Assets	-0.074	0.097	-0.453	-0.041	0.201	-0.158	0.024	0.094	0.211	-0.035	0.052	-0.139	-0.238	0.897																	
15	Funded Debt (Borrowings)/Shareholders Funds	0.048	-0.054	0.046	0.113	-0.047	0.039	0.001	0.041	0.063	-0.090	-0.378	-0.102	0.101	-0.125	0.465																
16	Funds From Operations/Total Liabilities	-0.018	-0.040	-0.683	0.023	0.186	0.111	-0.161	-0.197	0.032	-0.059	0.036	-0.011	-0.115	0.172	-0.004	0.870															
17	Absolute Value of Income Before Tax, Interest & Depreciation/Current Liabilities	-0.148	-0.130	-0.175	-0.211	0.056	0.092	0.074	0.028	0.044	0.074	-0.170	0.056	-0.018	-0.066	0.104	0.142	0.822														
18	Cash/Current Assets	0.040	-0.063	0.071	-0.157	-0.126	-0.015	0.096	-0.083	-0.127	0.002	0.070	0.093	-0.151	0.046	-0.030	0.065	0.042	0.671													
19	Liabilities Decomposition Measure	0.016	-0.103	-0.025	-0.059	0.039	-0.071	0.064	0.011	-0.040	-0.150	-0.197	-0.157	0.128	-0.006	0.143	0.044	0.092	-0.097	0.520												
20	Market Value of Equity/Total Liabilities	-0.005	0.049	0.050	0.086	0.003	0.033	-0.015	0.056	-0.145	0.054	0.015	0.026	-0.029	-0.050	0.017	-0.038	-0.324	-0.245	0.089	0.928											
21	Net Profit After Tax/Shareholders Funds	0.088	-0.011	0.060	0.074	-0.116	-0.071	0.091	0.241	-0.035	-0.147	-0.705	-0.065	0.105	-0.034	0.514	-0.144	-0.017	-0.087	0.122	-0.019	0.723										
22	Quick Assets/Current Assets	-0.716	-0.122	-0.086	-0.101	0.304	-0.035	0.274	0.028	-0.283	0.092	-0.011	-0.035	-0.011	0.104	-0.052	-0.003	0.023	-0.183	-0.062	0.098	-0.070	0.443									
23	Quick Liabilities/Current Liabilities	0.152	0.022	-0.051	0.077	0.014	0.050	-0.164	0.101	0.117	-0.069	-0.094	-0.014	0.154	-0.181	-0.061	0.088	0.069	-0.375	0.107	0.004	0.001	-0.232	0.550								
24	Retained Earnings/Total Assets	-0.010	0.001	-0.143	-0.105	0.055	-0.013	0.033	-0.176	0.113	-0.008	0.053	0.254	-0.267	0.072	-0.019	0.060	0.198	0.203	-0.027	-0.207	-0.019	-0.021	-0.041	0.841							
25	Shareholders Funds/Total Liab.	0.118	0.245	0.001	0.045	-0.338	0.498	-0.515	-0.013	-0.090	0.298	0.134	0.035	0.092	-0.079	-0.036	-0.098	-0.242	0.020	-0.183	-0.050	0.039	-0.167	-0.046	-0.219	0.703						
26	Taxation Liability (benefit) Assessed/Bef Tax Profit	0.035	0.025	-0.082	0.098	0.129	-0.030	-0.031	0.101	-0.095	-0.100	-0.124	-0.078	-0.015	0.152	0.078	0.088	-0.093	0.072	-0.086	-0.027	0.170	-0.048	-0.107	-0.206	-0.061	0.779					
27	Total Liabilities/Total Assets	0.125	0.295	-0.036	0.019	-0.410	0.238	-0.364	0.031	-0.065	0.275	0.052	-0.042	-0.035	0.075	-0.092	-0.076	-0.241	0.046	-0.183	0.025	0.056	-0.147	-0.088	-0.217	0.921	-0.068	0.691				
28	Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	0.076	-0.054	0.068	-0.063	-0.031	-0.181	0.214	-0.089	-0.132	-0.032	0.108	0.051	-0.140	0.071	-0.119	-0.024	-0.039	0.326	-0.011	-0.066	-0.031	0.108	-0.211	0.066	-0.206	0.015	-0.202	0.843			
29	Working Capital/Total Assets	0.210	0.256	0.172	-0.059	-0.603	-0.428	0.023	0.058	0.060	-0.043	-0.061	0.074	-0.147	0.088	-0.068	-0.102	-0.136	0.118	-0.078	-0.007	0.070	-0.076	-0.080	-0.078	0.349	-0.079	0.563	0.117	0.763		
30	Pretax Operating Income/Interest Expense	0.089	-0.027	0.114	0.135	0.001	-0.251	0.113	-0.026	0.102	-0.635	-0.084	-0.120	0.161	-0.084	0.083	-0.040	-0.001	-0.198	0.106	-0.010	0.041	-0.042	0.143	-0.281	-0.229	-0.031	-0.232	0.021	-0.016	0.795	
31	Current Assets/Retained Earnings (Adjusted to eliminate tax-effect accounting)	0.009	0.060	-0.063	0.052	0.040	0.083	-0.062	-0.194	0.009	0.053	0.041	0.024	-0.007	-0.051	0.001	0.166	0.014	-0.023	0.063	0.006	-0.140	-0.034	0.049	-0.104	-0.011	-0.130	-0.020	-0.040	-0.081	-0.148	0.820

70

Table 13

<u>Intercorrelations Matrices of Thirty-One Ratios for the 1997 Period</u>

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Quick Ratio	1.000																														
2	Balance Sheet Decomposition Measure	0.122	1.000																													
3	Cash Flow Before Tax/ Current Liabilities	0.094	-0.205	1.000																												
4	Assets Decomposition Meas.	0.159	0.304	-0.199	1.000																											
5	Current Assets/Current Liab.	0.835	0.053	0.095	0.092	1.000																										
6	Current Assets/Total Assets	0.329	0.141	-0.256	0.179	0.468	1.000																									
7	Current Assets/Total Liabilities	0.594	0.193	-0.092	0.163	0.741	0.687	1.000																								
8	Equities Decomposition Meas.	0.010	-0.117	0.042	-0.154	0.091	-0.074	-0.009	1.000																							
9	Current Liabilities/Total Liabilities	0.137	0.273	-0.241	0.144	0.169	0.521	0.737	-0.121	1.000																						
10	Earnings Before Interest and Tax/Interest Payments	-0.064	-0.256	0.520	-0.215	-0.052	-0.012	-0.077	0.089	-0.103	1.000																					
11	Returns on Shareholders Funds	-0.154	-0.114	0.579	-0.125	-0.173	0.054	-0.136	0.008	-0.075	0.587	1.000																				
12	Earnings Before Interest and Tax/Tangible Total Assets	-0.032	-0.150	0.769	-0.192	-0.037	-0.052	-0.079	0.028	-0.118	0.632	0.813	1.000																			
13	Earnings Before Interest and Tax/ Total Assets	-0.018	-0.104	0.771	-0.172	-0.015	0.007	-0.013	0.049	-0.046	0.642	0.846	0.950	1.000																		
14	Operating Income/Operating Assets	-0.067	-0.174	0.841	-0.215	-0.107	-0.294	-0.227	0.088	-0.243	0.598	0.682	0.832	0.824	1.000																	
15	Funded Debt (Borrowings)/ Shareholders Funds	-0.123	0.058	-0.007	0.025	-0.172	-0.088	-0.233	0.061	-0.224	-0.010	0.076	0.098	0.042	0.075	1.000																
16	Funds From Operations/Total Liabilities	0.035	-0.149	0.891	-0.209	0.056	-0.119	0.055	0.005	-0.037	0.563	0.582	0.764	0.783	0.769	-0.044	1.000															
17	Absolute Value of Income Before Tax, Interest & Depreciation/ Current Liabilities	0.353	0.040	0.314	-0.018	0.289	-0.207	0.101	0.093	-0.073	0.046	-0.008	0.150	0.154	0.244	-0.253	0.203	1.000														
18	Cash/Current Assets	0.279	0.095	-0.024	0.204	0.140	-0.082	0.020	0.025	0.007	-0.060	-0.019	-0.031	-0.031	0.063	-0.120	-0.105	0.226	1.000													
19	Liabilities Decomposition Measure	-0.089	0.068	-0.159	0.021	-0.079	0.016	0.032	-0.050	0.115	-0.060	-0.132	-0.157	-0.141	-0.168	-0.060	-0.110	-0.056	-0.071	1.000												
20	Market Value of Equity/Total Liabilities	0.451	0.019	0.213	0.073	0.485	0.023	0.519	0.102	0.320	0.086	-0.041	0.079	0.121	0.175	-0.276	0.235	0.549	0.210	-0.028	1.000											
21	Net Profit After Tax/Shareholders Funds	-0.106	-0.125	0.605	-0.119	-0.126	0.023	-0.116	-0.031	-0.071	0.574	0.951	0.772	0.814	0.681	-0.030	0.627	0.038	0.020	-0.132	0.013	1.000										
22	Quick Assets/Current Assets	0.411	0.163	-0.021	0.121	-0.049	-0.215	-0.112	-0.077	0.006	-0.112	-0.073	-0.073	-0.084	0.047	0.010	-0.127	0.282	0.397	-0.094	0.121	-0.038	1.000									
23	Quick Liabilities/Current Liabilities	0.104	0.074	0.121	0.143	0.068	-0.021	0.025	-0.062	0.017	0.009	0.099	0.066	0.058	0.135	-0.073	0.048	0.186	0.397	-0.151	0.136	0.120	0.260	1.000								
24	Retained Earnings/Total Assets	-0.020	-0.311	0.474	-0.193	0.024	-0.035	0.038	0.217	-0.102	0.402	0.295	0.380	0.387	0.384	-0.017	0.466	-0.001	-0.170	-0.027	0.151	0.238	-0.202	-0.101	1.000							
25	Shareholders Funds/Total Liab.	0.439	0.005	0.180	-0.046	0.480	-0.112	0.548	0.076	0.411	-0.055	-0.277	-0.048	-0.034	0.073	-0.310	0.193	0.452	0.195	0.015	0.689	-0.209	0.167	0.102	0.074	1.000						
26	Taxation Liability (benefit) Assessed/Bef Tax Profit	-0.118	-0.128	0.186	-0.029	-0.077	0.029	-0.077	0.029	-0.077	0.234	0.274	0.303	0.258	0.185	0.152	0.170	-0.089	-0.135	-0.039	-0.002	0.146	-0.126	-0.121	0.381	-0.099	1.000					
27	Total Liabilities/Total Assets	-0.439	-0.005	-0.180	0.046	-0.480	0.112	-0.548	-0.076	-0.411	0.055	0.277	0.048	0.034	-0.073	0.310	-0.193	-0.452	-0.195	-0.015	-0.689	0.209	-0.167	-0.102	-0.074	-1.000	0.099	1.000				
28	Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	-0.654	-0.020	-0.147	-0.078	-0.587	-0.139	-0.398	-0.095	-0.081	0.005	0.012	-0.098	-0.086	-0.062	0.111	-0.112	-0.215	-0.418	-0.006	-0.350	-0.021	-0.217	-0.075	-0.062	-0.362	0.072	0.362	1.000			
29	Working Capital/Total Assets	0.703	0.071	-0.011	0.093	0.883	0.689	0.775	0.073	0.286	-0.008	-0.125	-0.013	0.027	-0.135	-0.138	0.011	0.164	0.045	-0.114	0.379	-0.117	-0.096	0.017	0.040	0.371	-0.014	-0.371	-0.409	1.000		
30	Pretax Operating Income/ Interest Expense	-0.085	-0.205	0.451	-0.161	-0.075	0.030	-0.040	0.114	-0.076	0.908	0.518	0.566	0.571	0.535	0.011	0.514	0.032	-0.059	-0.028	0.085	0.500	-0.108	0.011	0.427	-0.064	0.247	0.064	0.041	0.013	1.000	
31	Current Assets/Retained Earnings (Adjusted to eliminate tax-effect accounting)	-0.027	-0.224	0.126	-0.128	0.031	0.080	0.012	0.189	-0.090	0.289	0.215	0.198	0.178	0.161	0.055	0.136	-0.046	-0.038	0.013	0.053	0.172	-0.124	-0.007	0.362	-0.064	0.229	0.064	0.021	0.092	0.346	1.000

Table 14

Anti-Image Matrices of Thirty Ratios for the 1997 Period

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	26	27	28	29	30	31
1	Quick Ratio	0.706																													
2	Balance Sheet Decomposition Measure	0.005	0.721																												
3	Cash Flow Before Tax/ Current Liabilities	0.037	0.103	0.793																											
4	Assets Decomposition Meas.	-0.091	-0.177	-0.135	0.748																										
5	Current Assets/Current Liab.	-0.548	-0.050	-0.406	0.137	0.638																									
6	Current Assets/Total Assets	-0.040	0.172	-0.011	0.006	0.190	0.600																								
7	Current Assets/Total Liabilities	-0.151	-0.051	0.304	-0.138	-0.481	-0.308	0.686																							
8	Equities Decomposition Meas.	0.115	0.023	0.107	0.088	-0.124	0.033	0.034	0.582																						
9	Current Liabilities/Total Liabilities	0.155	-0.140	-0.158	0.086	0.390	-0.260	-0.723	-0.009	0.563																					
10	Earnings Before Interest and Tax/Interest Payments	-0.087	0.138	0.130	0.046	-0.226	-0.053	0.313	0.056	-0.248	0.773																				
11	Returns on Shareholders Funds	-0.084	-0.063	-0.106	0.070	0.172	-0.034	-0.085	-0.059	0.019	-0.075	0.790																			
12	Earnings Before Interest and Tax/Tangible Total Assets	-0.020	0.106	0.071	0.023	-0.068	-0.007	0.091	0.150	-0.064	0.069	-0.087	0.879																		
13	Earnings Before Interest and Tax/ Total Assets	-0.010	-0.103	-0.134	0.001	0.153	0.129	-0.138	-0.132	-0.005	-0.145	-0.225	-0.676	0.868																	
14	Operating Income/Operating Assets	0.063	-0.085	-0.339	0.039	0.068	-0.067	0.099	-0.082	0.069	-0.043	-0.009	-0.192	-0.118	0.930																
15	Funded Debt (Borrowings)/ Shareholders Funds	0.003	-0.052	0.001	-0.046	0.009	0.125	-0.092	-0.080	0.063	-0.037	-0.205	-0.117	0.097	-0.114	0.637															
16	Funds From Operations/Total Liabilities	-0.134	-0.106	-0.692	0.137	0.353	0.007	-0.308	0.009	0.182	-0.092	0.330	-0.087	-0.074	0.039	-0.024	0.805														
17	Absolute Value of Income Before Tax, Interest & Depreciation/ Current Liabilities	-0.029	-0.119	-0.157	0.039	-0.019	-0.088	0.064	-0.088	0.120	0.063	-0.042	-0.094	-0.043	0.124	0.201	0.088	0.761													
18	Cash/Current Assets	-0.027	-0.026	0.112	-0.158	-0.075	-0.076	0.202	-0.015	-0.113	0.087	0.029	0.072	-0.082	-0.103	0.056	0.045	-0.011	0.679												
19	Liabilities Decomposition Measure	-0.011	-0.076	0.019	-0.006	-0.039	-0.143	0.032	0.062	0.011	0.038	0.016	0.065	-0.078	0.028	0.013	0.026	-0.036	0.058	0.625											
20	Market Value of Equity/Total Liabilities	0.005	0.086	0.178	-0.131	-0.077	0.165	-0.138	0.011	-0.053	-0.019	0.010	0.137	-0.029	-0.249	0.019	-0.069	-0.424	-0.039	0.017	0.841										
21	Net Profit After Tax/Shareholders Funds	0.138	0.097	0.097	-0.067	-0.229	-0.038	0.067	0.077	-0.006	0.037	-0.871	0.084	0.022	-0.021	0.269	-0.319	0.083	-0.045	0.020	-0.052	0.774									
22	Quick Assets/Current Assets	-0.829	-0.065	-0.066	0.057	0.477	0.052	0.211	-0.035	-0.225	0.095	0.112	0.050	0.009	-0.071	-0.081	0.184	-0.093	-0.029	0.065	0.005	-0.178	0.389								
23	Quick Liabilities/Current Liabilities	0.249	-0.022	-0.105	-0.078	-0.142	-0.081	-0.101	0.050	0.105	-0.016	-0.122	-0.059	0.111	-0.011	0.038	0.009	-0.017	-0.319	0.096	-0.014	0.095	-0.275	0.529							
24	Retained Earnings/Total Assets	-0.101	0.131	-0.292	0.069	0.253	0.010	-0.218	-0.156	0.199	-0.010	-0.095	0.067	0.001	0.029	0.120	0.059	0.137	0.040	-0.001	-0.108	0.140	0.088	0.041	0.805						
26	Taxation Liability (benefit) Assessed/Bef Tax Profit	0.125	-0.002	-0.041	-0.092	-0.053	-0.065	-0.015	-0.006	0.085	-0.015	-0.297	-0.190	0.103	0.129	-0.009	-0.004	0.098	-0.017	0.016	-0.119	0.301	-0.125	0.143	-0.184	0.016	0.678				
27	Total Liabilities/Total Assets	-0.109	-0.204	0.112	-0.116	-0.055	-0.719	0.330	0.012	0.245	0.082	-0.082	0.039	-0.152	0.168	-0.163	0.091	0.155	0.129	0.122	0.084	0.002	0.125	0.013	-0.007	-0.023	0.054	0.669			
28	Current Liabilities (excluding overdrafts)/(Cash + Market Value of Listed Securities + Net Trade Debtors)	0.144	-0.047	-0.096	-0.001	0.191	0.017	0.009	0.083	-0.015	-0.022	0.071	0.142	-0.049	0.009	-0.030	0.079	-0.116	0.362	0.100	-0.017	-0.064	0.034	-0.129	0.101	-0.068	-0.040	-0.044	0.834		
29	Working Capital/Total Assets	0.131	-0.049	0.160	-0.007	-0.508	-0.643	0.057	0.019	0.212	0.104	-0.011	0.039	-0.227	-0.055	-0.036	-0.015	0.044	0.044	0.208	0.028	0.133	-0.172	0.116	-0.031	0.031	0.038	0.403	-0.192	0.722	
30	Pretax Operating Income/ Interest Expense	0.058	-0.084	-0.050	-0.036	0.241	0.043	-0.288	-0.079	0.242	-0.862	0.078	-0.094	0.123	-0.031	-0.013	0.011	-0.050	-0.098	-0.081	-0.004	-0.061	-0.081	0.007	-0.009	-0.060	-0.003	-0.088	-0.021	-0.136	0.751
31	Current Assets/Retained Earnings (Adjusted to eliminate tax-effect accounting)	0.017	0.098	0.055	0.057	-0.008	0.024	-0.012	-0.088	0.024	0.059	-0.065	-0.068	0.095	-0.006	-0.033	-0.014	0.028	-0.056	-0.008	-0.056	0.030	-0.009	-0.014	-0.030	0.195	-0.038	-0.036	-0.069	-0.064	-0.134

Note: value 0.852 appears as the final diagonal entry for row 31.

The Financial Patterns of Australian Industrial Firms

Examination of the Factor Structure

The thirty-one ratios for the pooled data (i.e., 1989, 1993 and 1997) were subjected to a factor analysis (principal components analysis with PROMAX rotation).[39] Initial factor analysis showed that there were eight possible dimensions with eigenvalues greater than one and total variance explained of 72.723% (Table 15).[40]

Table 15

Results for the Extraction of 8 Component Factors

Factor	Eigenvalue	Percent of Variance	Cumulative Percent of Variance
1	7.541	24.326	24.326
2	5.688	18.347	42.673
3	2.400	7.743	50.416
4	1.947	6.280	56.696
5	1.626	5.244	61.940
6	1.193	3.850	65.790
7	1.097	3.538	69.327
8	1.053	3.395	72.723

---

[39] Two types of rotations were available. Under the orthogonal rotation, factor axes were kept orthogonal (right angles) to each other. By contrast, under oblique rotation, factor axes need not be orthogonal, and were allowed to rotate freely in order to arrive at the 'best' data clustering (Hair et al., 1995). Appendix 2 shows the twenty-six ratios that were rotated using orthogonal rotation (VARIMAX). The results obtained under both techniques (PROMAX results in Table 18 for the six factors) were very similar but oblique rotation (PROMAX) provided a better clustering of variables. In addition, prior studies such as Pinches et al. (1973; 1975) and Ezzamel et al. (1987) had similarly opted for using oblique rotation.

[40] Eigenvalues represents the amount of variance accounted for by a factor (Hair et al., 1995).

These eight dimensions were tested for stability and relevance. The within-group factor comparability test was used to compare two randomly selected sub-groups of the original group of firms (Nunnally, 1978; Everett & Entrekin, 1980). Using this method, a set of weights was applied to the ratios before obtaining factor scores for each randomly selected half of the data set. The factor scores from the two analyses were then compared to establish within-group factor stability and relevance.

The random split-halves factor comparability test (comparing the factor structure of one half of the total population with the other) was tested on the pooled data (comprising of 1989, 1993 and 1997) to determine the stability of the factor structure for all the years. The results showed a lack of stability when the 8-factor solution was used (Pearson correlation coefficients for the eight factors being 0.991, 0.585, 0.400, -0.391, -0.123, -0.106, 0.022, 0.179). In determining the stability of the factor structure, the common cut-off for r is ≥ 0.894 (implying a shared variance of at least 80%) (Everett & Entrekin, 1980).

The next step involved the removal of two ratios (ratio 24 – "retained earnings to total assets" and ratio 26 – "taxation liability (benefit) assessed to before tax profit/loss" from the pooled data that had factor loadings of less than 0.450.[41, 42] Because these factors had weak correlations, the next step was to consider whether the remaining 29 ratios could be meaningfully reduced to seven factors. Re-specification of the factor

---

[41] Factor loading is the correlation of the variable and the factor, the squared loading is the amount of the variable's total variance accounted for by the factor.

structure into seven factors showed within-group comparability correlation of 0.999, 0.985, 0.990, 0.897, -0.848, -0.895 and 0.684, respectively. Correlations of Factor 7 showed a lack of comparability, which demonstrated that lesser factor might improve the stability of the factor structure. Table 16 shows the seven dimensions with eigenvalues greater than one and total variance explained of 71.705%.

Table 16

Results for the Extraction of 7 Component Factors

Factor	Eigenvalue	Percent of Variance	Cumulative Percent of Variance
1	7.091	24.453	24.453
2	5.617	19.368	43.821
3	2.369	8.170	51.991
4	1.862	6.419	58.411
5	1.606	5.539	63.950
6	1.173	4.043	67.994
7	1.076	3.712	71.705

In the next stage, three ratios (ratio 28 – "current liabilities (exclude overdrafts) to cash + market value of listed securities + net trade debtors", ratio 8 – "equities decomposition measure" and ratio 31 – "current assets to retained earnings (adjusted to eliminate tax-effect accounting)") from the pooled data that had factor loadings of less than 0.450 in absolute value were removed from the factor analysis. The final set of twenty-six ratios was factor analysed (with six factors specified) and a within-group

---

[42] Tabachnick and Fidell (1996) suggested that loading of 0.450 (in absolute value) or above was fair (20% overlapping variance) and could be interpreted.

factor comparability test was performed. The correlations for the six factors were 0.998, 0.961, 0.962, 0.964, 0.813[43] and 0.929, respectively. This implied that the financial ratios could be meaningfully determined in six (not eight) dimensions. Table 17 contains information regarding the six factors and their relative explanatory power as expressed by their eigenvalues. In addition, a scree test (Figure 14) also indicated a 6-factor solution might be appropriate.

Table 17

Results for the Extraction of 6 Component Factors

Factor	Eigenvalue	Percent of Variance	Cumulative Percent of Variance
1	6.881	26.464	26.464
2	5.366	20.637	47.102
3	2.323	8.935	56.036
4	1.813	6.972	63.009
5	1.468	5.648	68.657
6	1.147	4.413	73.070

---

[43] It was mentioned earlier that Everett and Entrekin (1980) recommended a common cut-off level of $r \geq 0.894$. However, it was reasonable to believe that the coefficient of ≥ 0.813 was an acceptable level.
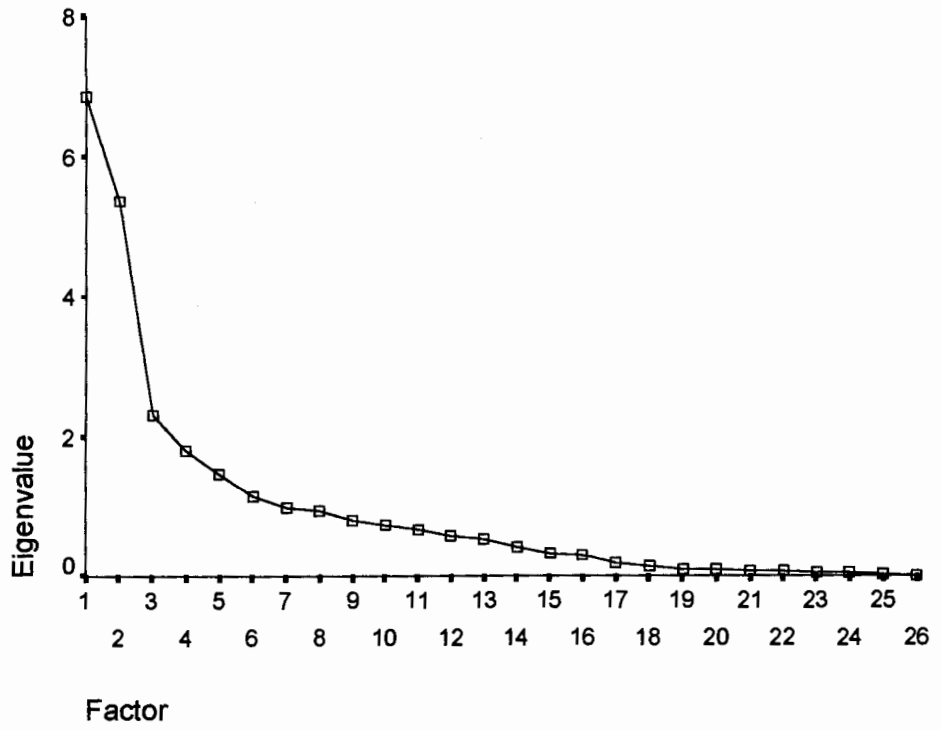
Figure 14. Scree test for common factor solution.

Interpreting the Factors

There is always some degree of subjectivity in the labeling of factors. However, the results could be assessed in detail by carefully examining the factor loadings of ratios that clustered onto each factor.

Factor 1 had nine ratios with significant loadings (Table 18) and involved the measurement of mainly Return on Investment. Ratio 13 ("earnings before interest and tax to total assets"), ratio 21 ("net profit after tax to shareholders funds") and ratio 11 ("returns on shareholders funds") were similarly classified as Return on Investment by prior studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Taffler & Sudarsanam, 1979; Laurent, 1979; Ezzamel et al., 1987). Ratio 16 ("funds from operations to total liabilities") loaded in Johnson's (1978; 1979) and Ezzamel et al.'s (1987) Return on Investment factor. Ratio 3 ("cash flow before tax to current liabilities") was also found to have high loading under this factor in Ezzamel et al.'s (1987) study. The remaining four ratios (ratio 12 – "earnings before interest and tax to tangible total assets", ratio 14 – "operating income to total assets", "earnings before interest and tax to interest payments" and ratio 30 – "pretax operating income to interest expense") denoted some measure of a firm's profitability.

Table 18

Results of Principal Components Analysis (PROMAX Rotation) for the Pooled Data

Ratio Number	Factor and Ratio Name	Factor Loading
Factor 1 – Return on Investment		
13	Earnings Before Interest and Tax to Total Assets	0.938
12	Earnings Before Interest and Tax to Tangible Total Assets	0.923
14	Operating Income to Operating Assets	0.852
21	Net Profit After Tax to Shareholders Funds	0.841
11	Returns on Shareholders Funds	0.836
16	Funds from Operations to Total Liabilities	0.817
3	Cash Flow Before Tax to Current Liabilities	0.814
10	Earnings Before Interest and Tax to Interest Payments	0.777
30	Pretax Operating Income to Interest Expense	0.703
Factor 2 – Short-Term Liquidity I		
29	Working Capital to Total Assets	0.945
5	Current Assets to Current Liabilities	0.874
6	Current Assets to Total Assets	0.859
7	Current Assets to Total Liabilities	0.766
1	Quick Ratio	0.704
Factor 3 – Financial Leverage I		
25	Shareholders Funds to Total Liabilities	0.908
27	Total Liabilities to Total Assets	-0.891
20	Market Value of Equity to Total Liabilities	0.721
17	Absolute Value of Income Before Tax, Interest & Depreciation to Current Liabilities (exclude overdrafts)	0.712
Factor 4 – Short-Term Liquidity II		
23	Quick Liabilities to Current Liabilities	0.793
18	Cash to Current Assets	0.772
22	Quick Assets to Current Assets	0.630
Factor 5 – Financial Leverage II		
9	Current Liabilities to Total Liabilities	0.853
15	Funded Debt (borrowings) to Shareholder Funds	-0.631

Ratio Number	Factor and Ratio Name	Factor Loading

Factor 6 – Decomposition Measure

Ratio Number	Factor and Ratio Name	Factor Loading
2	Balance Sheet Decomposition Measure	0.694
4	Asset Decomposition Measure	0.606
19	Liabilities Decomposition Measure	0.586

In Factor 2, the five ratios shown in Table 18 focussed on a firm's ability to meet current payments as they became due. Therefore the factor could be labeled as Short-Term Liquidity I.[44] Ratio 29 ("working capital to total assets") was found in Ezzamel et al.'s (1987) Short-Term Liquidity factor. Ratio 5 ("current assets to current liabilities") similarly loaded under this factor in most prior studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Laurent, 1979; Ezzamel et al., 1987), while ratio 6 ("current assets to total assets") was found in Pinches et al.'s (1973; 1975) and Ezzamel et al.'s (1987) Short-Term Liquidity factor. Ratio 7 ("current assets to total liabilities") and ratio 1 ("quick ratio") measured a firm's liquidity and its debt paying ability, and hence were considered to be part of this factor.

For Factor 3, the four ratios (Table 18) could be descriptively labeled as Financial Leverage I.[45] Prior studies (Pinches et al., 1973; 1975 and Johnson, 1978; 1979) had similarly classified ratio 27 ("total liabilities to total assets") in their Financial Leverage factor. The remaining three ratios (ratio 25 – "shareholders funds to total

---

[44] This study found two factors related to Short-Term Liquidity, and classified them as Short-Term Liquidity I and Short-Term Liquidity II.

80

liabilities", ratio 20 – "market value of equity to total liabilities" and ratio 17 –

"absolute value of income before tax, interest & depreciation to current liabilities

(exclude overdrafts)") were not included in any of the factors in prior studies. Each of

these ratios represented a description of the solvency of a firm, and hence could be

considered to be a measure of financial leverage nature. For example, ratio 20

("market value of equity to total liabilities") showed "how much the firm assets could

decline in value (measured by market value of equity plus debt) before the liabilities

exceed the assets and the firm became insolvent" (Altman, 1968, p. 595). Ratio 25

("shareholders funds to total liabilities") was often used as a measure of financial

leverage (Altman, 1968). Ratio 17 ("absolute value of income before tax, interest &

depreciation to current liabilities (excluding overdrafts)") measured the ability of the

firm to pay its debt. Hence this factor was labeled as Financial Leverage I.

Three ratios (Table 18) loaded in Factor 4 and this factor could be termed as Short-

Term Liquidity II. Ratio 23 ("quick liabilities to current liabilities") showed the

amount of short-term funding that was provided by creditors. Both ratio 18 ("cash to

current assets") and ratio 22 ("quick assets to current assets") measured the amount of

funds in cash or funds to repay debt. These ratios indicated the availability of short-

term funds in generating profits for the firm.

As seen in Table 18, only two ratios, ratio 9 ("current liabilities to total liabilities") and

ratio 15 ("funded debt (borrowings) to shareholder funds") loaded in Factor 5. Both

---

[45] This study found two factors related to Financial Leverage, and hence had classified them as Financial Leverage I and Financial Leverage II.

ratios related to borrowings and leverage, therefore, they may be labeled as <u>Financial</u>

<u>Leverage II</u>. Ratio 9 ("current liabilities to total liabilities") measured the proportion of

a firm's total borrowings which was payable within the short-term, whilst, ratio 15

("funded debt (borrowings) to shareholder funds") measured the level of borrowings in

relation to shareholders' investment (or net assets). These two ratios provided an

indication of the firm's debts, and were concerned with the financial leverage of the

firm.

Table 18 shows that three ratios (ratio 2 – "balance sheet decomposition measure",

ratio 4 – "asset decomposition measure" and ratio 19 – "liabilities decomposition

measure") loaded on Factor 6 and the factor could therefore be labeled as a

<u>Decomposition Measure</u>. These ratios were similar to the ratios that loaded on

Johnson's (1979) <u>Decomposition Measure</u> factor.

Subsequent to determining the first-order factors, second-order factors or higher-order

classifications could also be calculated (Rummel, 1970).[46] The second-order factor

analysis of the first-order factors specified the empirical similarities among these

factors, and assisted in determining the interrelationships of the six factors (<u>Return on</u>

<u>Investment</u>, <u>Short-Term Liquidity I</u>, <u>Financial Leverage I</u>, <u>Short-Term Liquidity II</u>,

<u>Financial Leverage II</u> and <u>Decomposition Measure</u>). The results (Table 19) showed

that the first higher-order factor included the first-order classifications of <u>Financial</u>

<u>Leverage I</u> and <u>Short-Term Liquidity II</u>. <u>Short-Term Liquidity</u> related to the ability of

---

[46] Second-order factors or higher-order factors were performed on the factor scores of the six first-order classifications.

82

the firm to meet its current obligations, while <u>Financial Leverage</u> related to long-term

obligations. This factor was labeled as <u>Liquidity I</u>.[47]

Table 19

<u>Classifications and Factor Loadings (with VARIMAX Rotation) Defining Three
Higher-Order Factors for the Pooled Data</u>[48]

First-order Classification	Higher-Order Classification of Factor Loadings		
	1	2	3
Financial Leverage I	0.842		
Short-Term Liquidity II	0.544		
Financial Leverage II		0.844	
Short-Term Liquidity I		0.664	
Return on Investment			- 0.763
Decomposition Measure			0.705

The second higher-order factor (Table 19) included the first-order classifications of

<u>Financial Leverage II</u> and <u>Short-Term Liquidity I</u>, therefore the factor was labeled as

<u>Liquidity II</u>.

Finally, the third higher-order factor included the first-order classifications of <u>Return

on Investment</u> and <u>Decomposition Measure</u>, and was labeled as <u>Return on Invested

Capital</u>. This factor demonstrated the interrelationship between a firm's return on

---

[47] There are two higher-order factors related to <u>Liquidity</u>, and had classified them as <u>Liquidity I</u> and <u>Liquidity II</u>.

[48] It showed three higher-order factors extracted and the variance explained were 25.527% for Factor 1, 23.789% for Factor 2 and 18.837% for Factor 3. The eigenvalues were 1.532 for Factor 1, 1.427 for Factor 2 and 1.130 for Factor 3.

investment and the change in the composition of the balance sheet items. One notable

occurrence was the negative sign on <u>Return on Investment</u>. The relationship between

<u>Return on Investment</u> and <u>Decomposition Measure</u> is indirect because when the

decomposition measure increases (signaling the firm was not in a sound position) the

return on investment would decrease.[49]

Within-Year Structure

The reduced space represented by the six factors accounted for a consistently high

amount of information (variance) contained in the data matrix – 74.551% in 1989,

74.003% in 1993, and 74.580% in 1997.

Table 20 shows the twenty-six ratios that grouped into the six factors for the 1989

period. Each of the six factors seemed to have the same characteristics as the pooled

data. The six factors had the same items loading in each factor as the pooled data,

except for Factor 4 (<u>Financial Leverage II</u>) and Factor 5 (<u>Short-Term Liquidity II</u>)

which had swapped position.

---

[49] Prior studies (e.g., Dambolena & Khoury, 1980; Booth, 1983) found differences in the size and
stability of the decomposition measures of failed and non-failed firms. The indication was that the
decomposition measures of failed firms were larger and less stable over time than those of non-failed
firms.

A similar analysis (principal components analysis with PROMAX rotation) was performed on the twenty-six ratios for the 1993 period. As seen in Table 21, Factor 1 (Return on Investment) was similar to the pooled data in terms of the ratios that loaded under this factor. In Factor 2, the items that loaded in this factor was a combination of Short-Term Liquidity (ratio 5 – "current assets to current liabilities", ratio 1 – "quick ratio" and ratio 29 – "working capital to total assets") and Financial Leverage (ratio 25 – "shareholders funds to total liabilities", ratio 27 – "total liabilities to total assets", ratio 7 – "current assets to total liabilities", ratio 20 – "market value of equity to total liabilities" and ratio 17 – "absolute value of income before tax, interest & depreciation to current liabilities (excluding overdrafts)"). Despites of this, this factor contained mostly leverage characteristics and were labeled as Financial Leverage I.

In Factor 3, the items that loaded onto this factor were ratio 6 ("current assets to total assets") and ratio 9 ("current liabilities to total liabilities"). These items were reflective of Short-Term Liquidity I. Factor 4 (Short-Term Liquidity II) was similar to the pooled data in terms of the ratios loaded under this factor. Factor 5 contained some decomposition measure (ratio 4 – "assets decomposition measure" and ratio 2 – "balance sheet decomposition measure"), while Factor 6 appeared to be less clear because only one item (ratio 15 – "funded debt to shareholders funds") loaded onto the factor. Because of its high loading (-0.911), it was labeled as Financial Leverage II.

Table 20

Factor Matrix (PROMAX Rotation) for the 1989 Period

Ratio Number	Ratio Name	Return on Investment 1	Short-Term Liquidity I 2	Financial Leverage I 3	Financial Leverage II 4	Short-Term Liquidity II 5	Decomposition Measure 6
13	Earnings Before Interest & Tax to Total Assets	0.900					
12	Earnings Before Interest & Tax to Tangible Total Assets	0.894					
14	Operating Income to Operating Assets	0.878					
16	Funds From Operations to Total Liabilities	0.841					
3	Cash Flow Before Tax to Current Liabilities	0.839					
21	Net Profit After Tax to Shareholders Funds	0.829					
10	Earnings Before Interest & Tax to Interest Payments	0.819					
30	Pretax Operating Income to Interest Expense	0.811					
11	Returns on Shareholders Funds	0.753					
29	Working Capital to Total Assets		0.978				
5	Current Assets to Current Liabilities		0.954				
7	Current Assets to Total Liabilities		0.810				
6	Current Assets to Total Assets		0.799				
1	Quick Ratio		0.716				
25	Shareholders Funds to Total Liabilities			0.896			
27	Total Liabilities to Total Assets			-0.896			
17	Absolute Value of Income Before Tax, Interest & Depreciation to Current Liabilities (exclude Overdrafts)			0.719			
20	Market Value of Equity to Total Liabilities			0.662			
9	Current Liabilities to Total Liabilities				0.897		
15	Funded Debt (borrowings) to Shareholder Funds				-0.602		
18	Cash to Current Assets					0.804	
22	Quick Assets to Current Assets					0.742	
23	Quick Liabilities to Current Liabilities					0.628	
2	Balance Sheet Decomposition Measure						0.729
4	Assets Decomposition Measure						0.665
19	Liabilities Decomposition Measure						0.610

Note. Total Variance Explained = 74.551%.

Table 21

Factor Matrix (PROMAX Rotation) for the 1993 Period

Ratio Number	Ratio Name	Return on Investment 1	Financial Leverage I 2	Short-Term Liquidity I 3	Short-Term Liquidity II 4	Decomposition Measure 5	Financial Leverage II 6
13	Earnings Before Interest & Tax to Total Assets	0.944					
12	Earnings Before Interest & Tax to Tangible Total Assets	0.942					
14	Operating Income to Operating Assets	0.870					
3	Cash Flow Before Tax to Current Liabilities	0.827					
11	Returns on Shareholders Funds	0.818					
10	Earnings Before Interest & Tax to Interest Payments	0.791					
16	Funds From Operations to Total Liabilities	0.785					
21	Net Profit After Tax to Shareholders Funds	0.739					
30	Pretax Operating Income to Interest Expense	0.653					
5	Current Assets to Current Liabilities		0.930				
25	Shareholders Funds to Total Liabilities		0.882				
1	Quick Ratio		0.871				
27	Total Liabilities to Total Assets		-0.832				
29	Working Capital to Total Assets		0.787				
7	Current Assets to Total Liabilities		0.756				
20	Market Value of Equity to Total Liabilities		0.636				
17	Absolute Value of Income Before Tax, Interest & Depreciation to Current Liabilities (exclude Overdrafts)		0.629				
6	Current Assets to Total Assets			0.905			
9	Current Liabilities to Total Liabilities			0.592			
23	Quick Liabilities to Current Liabilities				0.850		
18	Cash to Current Assets				0.733		
22	Quick Assets to Current Assets				0.689		
4	Assets Decomposition Measure					0.696	
2	Balance Sheet Decomposition Measure					0.555	
15	Funded Debt (borrowings) to Shareholder Funds						-0.911

Note. Total Variance Explained = 74.003%.

Table 22 shows the six factors for the 1997 period. Re-specification of the factor

analytic model for the six factors produced by factor analysis (principal components

analysis with PROMAX rotation) were very similar to that of the pooled data. Factor 1

(Return on Investment), Factor 2 (Short-Term Liquidity I), Factor 3 (Financial

Leverage I) and Factor 4 (Short-Term Liquidity II) were similar to the pooled data in

terms of the ratios that loaded under these factors (Table 18). In Factor 5, the two

ratios (ratio 9 – "current liabilities to total liabilities" and ratio 15 – "funded debt

(borrowings) to shareholder funds") that loaded in this factor were similar to that of

the pooled data and was labeled as Financial Leverage II. Factor 6 showed two ratios

(ratio 2 – "balance sheet decomposition measure" and ratio 4 – "assets decomposition

measure") loaded on the factor and was labeled as Decomposition Measure.

Table 22

Factor Matrix (PROMAX Rotation) for the 1997 Period

Ratio Number	Ratio Name	Return on Investment 1	Short-Term Liquidity I 2	Financial Leverage I 3	Short-Term Liquidity II 4	Financial Leverage II 5	Decomposition Measure 6
13	Earnings Before Interest & Tax to Total Assets	0.983					
12	Earnings Before Interest & Tax to Tangible Total Assets	0.949					
11	Returns on Shareholders Funds	0.921					
21	Net Profit After Tax to Shareholders Funds	0.900					
14	Operating Income to Operating Assets	0.846					
16	Funds From Operations to Total Liabilities	0.838					
3	Cash Flow Before Tax to Current Liabilities	0.786					
10	Earnings Before Interest & Tax to Interest Payments	0.666					
30	Pretax Operating Income to Interest Expense	0.615					
29	Working Capital to Total Assets		1.001				
5	Current Assets to Current Liabilities		0.934				
6	Current Assets to Total Assets		0.810				
1	Quick Ratio		0.785				
7	Current Assets to Total Liabilities		0.679				
25	Shareholders Funds to Total Liabilities			0.971			
27	Total Liabilities to Total Assets			-0.971			
20	Market Value of Equity to Total Liabilities			0.743			
17	Absolute Value of Income Before Tax, Interest & Depreciation to Current Liabilities (exclude Overdrafts)			0.613			
18	Cash to Current Assets				0.773		
23	Quick Liabilities to Current Liabilities				0.686		
22	Quick Assets to Current Assets				0.593		
9	Current Liabilities to Total Liabilities					0.847	
15	Funded Debt (borrowings) to Shareholder Funds					-0.494	
19	Liabilities Decomposition Measure					0.474	
2	Balance Sheet Decomposition Measure						0.799
4	Assets Decomposition Measure						0.484

Note. Total Variance Explained = 74.580%.

89

Table 23 presents a summary of the results of the factor analysis for the individual years and the pooled data. Return on Investment was the most dominant factor extracted for 1989, 1993, 1997 and the pooled data. Short-Term Liquidity I was the second factor for 1989, 1997 and the pooled data, and the third factor for the 1993 period. Financial Leverage I was the third factor for the 1989, 1997 and the pooled data, and the second factor for the 1993 period. Short-Term Liquidity II was the fourth factor for 1993, 1997 and the pooled data, and the fifth factor for the 1989 period. Financial Leverage II was the fourth factor in 1989, the fifth factor in 1997 and the pooled data, and the sixth factor in 1993. Decomposition Measure was the fifth factor in 1993, and the sixth factor in 1989, 1997 and the pooled data.

Table 23

A Summary of the Order of Factors for 1989, 1993, 1997 and the Pooled Data

Factors	1989	1993	1997	Pooled Data
Return on Investment	1	1	1	1
Short-Term Liquidity I	2	3	2	2
Financial Leverage I	3	2	3	3
Short-Term Liquidity II	5	4	4	4
Financial Leverage II	4	6	5	5
Decomposition Measure	6	5	6	6

The Extent of Stability of Financial Patterns Over Time

The degree of temporal stability of the factor loadings and classifications were

analysed by (a) visual inspection of the ratios loading on each factor; (b) correlation

coefficient of the loadings on each factor for 1989 with 1993, 1993 with 1997, and

1989 with 1997; (c) calculating the percentage of absolute deviation in loadings for

each factor for 1989 with 1993, 1993 and 1997, and 1989 with 1997; (d) calculating

the t-tests of the differences between the means of the raw data in 1989 and 1993, 1993

and 1997, and 1989 and 1997 for each ratio; and (e) the performance of differential

factor analysis on the differences in ratios for 1989 with 1993, 1993 with 1997, and

1989 with 1997. It is important to note that the classification of the results of these

tests is essentially subjective.

By visual inspection of the ratios loading on each factor, Table 24 gives some

indication of the extent of stability in the financial patterns over the short-term (1989

and 1993, and 1993 and 1997) and long-term (1989 and 1997). It presents the factors,

financial ratios and loadings for all ratios that loaded at 0.450 or greater in 1989, 1993

or 1997. Comrey and Lee (1992, cited in Tabachnick & Fidell, 1996) suggested that

when the loadings for two comparative years were 0.630 (in absolute value) or above

(40% overlapping variance), and the ratio was interpreted as having high stability,

loadings of above 0.450 (in absolute value) and below 0.630 (in absolute value) was

moderate and was interpreted as moderate stability, and loadings of below 0.450 (in

absolute value) was poor and was interpreted as unstable.[50] For the short-term (1989 to

1993), all the ratios that loaded on Factor 1 had high loadings (i.e., ≥ 0.630 in absolute

value), indicating that the factor was highly stable. For Factor 2, four ratios had high

loadings (i.e., ≥ 0.630 in absolute value) between the years, and the other five ratios

had low loadings (i.e., ≤ 0.450 in absolute value). Therefore, overall Factor 2 was

moderately stable. Factor 3 was found to be unstable because four of the six ratios

were unstable (i.e., ≤ 0.450 in absolute value) between 1989 and 1993. Four of the five

ratios loaded on Factor 4 had low loadings (i.e., ≤ 0.450 in absolute value) between the

years, indicating that the factor was unstable. In Factor 5, all the ratios had loadings of

below 0.450 (in absolute value) across the years, indicating that the factor was

unstable. All the ratios loaded on Factor 6 had low loadings (i.e., ≤ 0.450 in absolute

value), showing that the factor was unstable.

---

[50] To determine stability, the factor loadings for both periods must be similar.

Table 24

Financial Ratios and Ratio Loadings Defining Six Financial Ratio Patterns for
Australian Industrial Firms: 1989, 1993, 1997

Ratio Number	Ratio Name	Ratio Loadings		
		1989	1993	1997
Factor 1				
13[a]	Earnings Before Interest & Tax/Total Assets	0.900	0.944	0.983
12[a]	EarningsBefore Interest & Tax/ Tangible Total Assets	0.894	0.942	0.949
14[a]	Operating Income/Operating Assets	0.878	0.870	0.846
16[a]	Funds From Operations/Total Liabilities	0.841	0.785	0.838
3[a]	Cash Flow Before Tax/Current Liabilities	0.839	0.827	0.786
21[a]	Net Profit After tax/Shareholders Funds	0.829	0.739	0.900
10[a]	Earnings Before Interest & Tax/Interest Expense	0.819	0.791	0.666
30[a]	Pretax Operating Income/Interest Expense	0.811	0.653	0.615
11[a]	Returns on Shareholders Funds	0.753	0.818	0.921
Factor 2				
29[a]	Working Capital/Total Assets	0.978	0.787	1.001
5[a]	Current Assets/Current Liabilities	0.954	0.930	0.934
7[a]	Current Assets/Total Liabilities	0.810	0.756	0.679
1[a]	Quick Ratio	0.716	0.871	0.785
6[b]	Current Assets/Total Assets	0.799	0.174	0.810
25[c]	Shareholders Funds/Total Liabilities	0.123	0.882	0.024
27[c]	Total Liabilities/Total Assets	-0.123	-0.832	-0.024
20[c]	Market Value of Equity/Total Liabilities	0.158	0.636	0.154
17[c]	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	-0.093	0.629	-0.005
Factor 3				
17[a]	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	0.719	-0.473	0.613
25[b]	Shareholders Funds/Total Liabilities	0.896	-0.116	0.971
27[b]	Total Liabilities/Total Assets	-0.896	0.080	-0.971
20[b]	Market Value of Equity/Total Liabilities	0.662	-0.118	0.743
6[b]	Current Assets/Total Assets	-0.603	0.905	-0.432
9[c]	Current Liabilities/Total Liabilities	0.183	0.592	0.307
Factor 4				
9[c]	Current Liabilities/Total Liabilities	0.897	0.260	-0.028
15[c]	Funded Debt (borrowings)/Shareholder Funds	-0.602	0.210	-0.259
23[a]	Quick Liabilities/Current Liabilities	0.457	0.850	0.686
18[b]	Cash/Current Assets	-0.032	0.733	0.773
22[b]	Quick Assets/Current Assets	-0.072	0.689	0.593

93

Ratio	Ratio Name	Ratio Loadings		
Number		1989	1993	1997

Factor 5

22[c]	Quick Assets/Current Assets	0.742	0.318	- 0.183
18[c]	Cash/Current Assets	0.804	0.096	-0.020
23[c]	Quick Liabilities/Current Liabilities	0.628	-0.286	0.029
4[c]	Asset Decomposition Measure	0.141	0.696	0.106
2[c]	Balance Sheet Decomposition Measure	0.104	0.555	0.214
9[c]	Current Liabilities/Total Liabilities	-0.071	-0.002	0.847
15[c]	Funded Debt (borrowings)/Shareholder Funds	-0.028	-0.147	-0.494
19[c]	Liabilities Decomposition Measure	-0.158	0.437	0.474

Factor 6

2[b]	Balance Sheet Decomposition Measure	0.729	0.020	0.799
4[b]	Asset Decomposition Measure	0.665	0.129	0.484
19[c]	Liabilities Decomposition Measure	0.610	0.122	0.049
15[c]	Funded Debt (borrowings)/Shareholder Funds	-0.251	-0.911	0.360

Note.

[a] – Loaded at ≥ 0.450 or $\geq$ - 0.450 in all three years.
[b] – Loaded at ≥ 0.450 or $\geq$ - 0.450 in two of the years.
[c] – Loaded at ≥ 0.450 or $\geq$ - 0.450 in only one year.

From 1993 to 1997, all but one of the ratios that loaded on Factor 1 had loadings of above 0.630 (in absolute value) (Table 24). It indicated that the factor was highly stable. In Factor 2, four of the nine ratios were highly stable (i.e., ≥ 0.630 in absolute value) and the other ratios were unstable (i.e., ≤ 0.450 in absolute value) between 1993 and 1997. Therefore, overall Factor 2 was moderately stable. For Factor 3, five of the six ratios had low loadings (i.e., ≤ 0.450 in absolute value) between the years, showing that the factor was unstable. For Factor 4, two of the five ratios had high loadings (i.e., ≥ 0.630 in absolute value) and one ratio had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value), indicating that overall the factor was moderately stable. For Factor 5, all the ratios had low loadings (i.e., ≤ 0.450 in absolute value)

94

between the years, showing that the factor was unstable. All the ratios loaded on

Factor 6 showed instability (i.e., loadings of ≤ 0.450 in absolute value), indicating that

the factor was unstable.

From 1989 to 1997, all but one of the ratios on Factor 1 had high loadings (i.e., $\geq$

0.630 in absolute value), indicating that the factor had high stability (Table 24). For

Factor 2, five of the nine ratios had high loadings (i.e., ≥ 0.630 in absolute value) in

both years, and the remaining ratios had low loadings (i.e., ≤ 0.450 in absolute value).

Overall, Factor 2 was moderately stable. Three of the six ratios loaded on Factor 3 had

high loadings (i.e., ≥ 0.630 in absolute value), one had moderately high loading (i.e.,

above 0.450 and below 0.630 in absolute value) and the other ratios had low loadings

(i.e., ≤ 0.450 in absolute value) from 1989 to 1997. Overall, Factor 3 was moderately

stable. For Factor 4, apart from one ratio that had moderately high loading (i.e., above

0.450 and below 0.630 in absolute value), the rest of the ratios had low loadings (i.e., $\leq$

0.450 in absolute value) between the years, indicating that the factor was unstable.

Factor 5 was unstable because all the ratios had low loadings (i.e., ≤ 0.450 in absolute

value). For Factor 6, one of the ratios had high loading (i.e., ≥ 0.630 in absolute value)

between the years, another had moderately high loading (i.e., above 0.450 and below

0.630 in absolute value) and the other two had low loadings (i.e., ≤ 0.450 in absolute

value). It showed that overall Factor 6 was moderately stable.

Differences in ratios that loaded in the factors might be due to a matter of chance as to

which factor was extracted first (Everett & Entrekin, 1980). To gain further insight

into the extent of the stability of the financial patterns, the correlation coefficients of the loadings on each factor for 1989 with 1993, 1993 with 1997, and 1989 with 1997 were calculated. These are shown in Table 25, 26 and 27 respectively.

The between-group factor comparability test was designed to compare two groups of factor scores. A set of weights was applied to a group before obtaining the factor scores. One set of scores was based on the score coefficients calculated from factor analysis of the first group, and the other set of scores was derived from the factor analysis of the second group (Nunnally, 1978; Everett & Entrekin, 1980). Examination of the correlation coefficients between 1989 and 1993 (Table 25) showed a lack of comparability (Pearson correlation coefficients in the "strong" sense for the six factors were 0.999, 0.785, -0.425, 0.309, 0.342 and 0.104).[51] As earlier mentioned, if two factors had approximately equal eigenvalues, it was very much a matter of chance as to which factor was extracted first (Nunnally, 1978; Everett & Entrekin, 1980). Based on this argument, it would be legitimate to report comparability coefficients in the "weak" sense.[52] For example, when the second factor from the 1989 period was compared with the third factor from the 1993 period, a coefficient of 0.617 was reported. When the third factor from the 1989 period was compared with the second factor from the 1993 period, a coefficient of 0.826 was reported. The comparability coefficients in the

---

[51] "Strong" comparability exists when the factor description and orders match.

[52] "Weak" comparability exists when the factor description matches but not the factor order.

"weak" sense were 0.999, 0.617, 0.826, 0.661, 0.886 and 0.877, respectively (Factors

2, 3, 4, 5 and 6 were moderately stable).[53]

Table 25

Comparability Coefficients for Rotated (PROMAX) Principal Components between
1989 period and 1993 period

	Factors	1989					
		1 ROI	2 STL I	3 FL I	4 FL II	5 STL II	6 DM
	1 - ROI	0.999	0.210	0.021	- 0.007	- 0.045	- 0.246
	2 - FL I	0.119	0.785	0.826	0.140	0.271	0.049
	3 - STL I	0.156	0.617	- 0.425	0.653	- 0.188	- 0.067
1993	4 - STL II	-0.008	0.162	0.126	0.309	0.886	0.060
	5 - DM	-0.238	-0.012	- 0.091	- 0.334	0.342	0.877
	6 - FL II	-0.038	- 0.067	0.344	0.661	-0.050	0.104

Note.

Factors were defined as: ROI = Return on Investment; STL I = Short-Term Liquidity I;
FL I = Financial Leverage I; STL II = Short-Term Liquidity II; FL II = Financial
Leverage II; DM = Decomposition Measure

Similarly, there was also a lack of comparability between 1993 and 1997 (Pearson

correlation coefficients in the "strong" sense for the six factors being 0.995, 0.748,

-0.345, 0.900, -0.165 and –0.140) (Table 26). By comparing the second factor from

1993 with the third factor from 1997, a "weak" comparability coefficient of 0.865 was

---

[53] Everett and Entrekin (1980) recommended a common cut-off level of r ≥ 0.894 for strong stability to
be established.

reported. When the third factor from the 1993 period was compared with the second

factor from the 1997 period, a coefficient of 0.633 was reported. Therefore,

comparability coefficients in the "weak" sense would be 0.995, 0.865, 0.633, 0.900,

0.732 and 0.604, respectively for the six factors (Factors 2, 3, 5 and 6 were moderately

stable) (Table 26).

Table 26

Comparability Coefficients for Rotated (PROMAX) Principal Components between
1993 period and 1997 period

		1993					
	Factors	1 ROI	2 FL I	3 STL I	4 STL II	5 DM	6 FL II
1997	1 - ROI	0.995	0.099	0.188	- 0.008	- 0.244	- 0.037
	2 - STL I	0.217	0.748	0.633	0.143	0.012	- 0.061
	3 - FL I	0.082	0.865	- 0.345	0.198	- 0.115	0.346
	4 - STL II	-0.039	0.174	- 0.016	0.900	0.284	0.137
	5 - FL II	-0.041	- 0.055	0.723	0.114	- 0.165	0.604
	6 - DM	- 0.390	0.005	- 0.083	0.200	0.732	- 0.140

Note.

Factors were defined as: ROI = Return on Investment; STL I = Short-Term Liquidity I;
FL I = Financial Leverage I; STL II = Short-Term Liquidity II; FL II = Financial
Leverage II; DM = Decomposition Measure

To examine long-term stability, factor comparability test between 1989 and 1997

factor scores were performed. Examination of the correlation coefficients between

1989 and 1997 (Table 27) showed a lack of comparability in the "strong" sense for Factors 4 (coefficient of 0.150), 5 (coefficient of -0.271) and 6 (coefficient of 0.664). Reported comparability coefficients in the "weak" sense would be 0.998, 0.991, 0.981, 0.904, 0.896 and 0.664, respectively for the six factors. These results suggested that the first five factors might be stable over the long-term. Factor 6 was moderately stable.

Table 27

Comparability Coefficients for Rotated (PROMAX) Principal Components between 1989 period and 1997 period

	Factors	1989					
		1 ROI	2 STL I	3 FL I	4 FL II	5 STL II	6 DM
1997	1 - ROI	0.998	0.213	-0.020	0.045	- 0.055	- 0.271
	2 - STL I	0.225	0.991	0.255	0.311	0.163	0.015
	3 - FL I	0.071	0.386	0.981	0.031	0.262	0.025
	4 - STL II	-0.027	0.172	0.069	0.150	0.896	0.149
	5 - FL II	-0.023	0.225	- 0.241	0.904	- 0.271	0.111
	6 - DM	- 0.395	- 0.025	0.014	-0.088	0.305	0.664

Note.

Factors were defined as: ROI = Return on Investment; STL I = Short-Term Liquidity I; FL I = Financial Leverage I; STL II = Short-Term Liquidity II; FL II = Financial Leverage II; DM = Decomposition Measure

The correlation coefficients for the financial patterns are summarised in Table 28 for

each factor for 1989 with 1993, 1993 with 1997, and 1989 with 1997. In the short-term

(1989 with 1993), Factor 1 (Return on Investment) was the most stable (correlation

coefficient of 0.999). Factor 2 (Short-Term Liquidity I), Factor 3 (Financial Leverage

I), Factor 4 (Short-Term Liquidity II), Factor 5 (Financial Leverage II) and Factor 6

(Decomposition Measure) were reflecting moderate stability (correlation coefficients

of 0.617, 0.826, 0.886, 0.661 and 0.877, respectively) between 1989 and 1993.

Table 28

Summary of Correlation Coefficients of Financial Patterns for Australian Industrial
Firms: 1989 with 1993, 1993 with 1997, and 1989 with 1997

	Factors					
	1 ROI	2 STL I	3 FL I	4 STL II	5 FL II	6 DM
Years						
1989; 1993	0.999	0.617*	0.826*	0.886*	0.661*	0.877*
1993; 1997	0.995	0.633*	0.865*	0.900	0.604*	0.732*
1989; 1997	0.998	0.991	0.981	0.896*	0.904*	0.664

Note.
1.   Factors were defined as: ROI = Return on Investment; STL I = Short-Term
      Liquidity I; FL I = Financial Leverage I; STL II = Short-Term Liquidity II; FL
      II = Financial Leverage II; DM = Decomposition Measure

2.   Asterisk (*) referred to comparability in the weak sense.

Correlation coefficients for 1993 with 1997 showed that Factor 1 (Return on

Investment) was stable between the two years (correlation coefficient of 0.995) (Table

28). Factor 2 (Short-Term Liquidity I) and Factor 3 (Financial Leverage I) were

moderately stable (correlation coefficients of 0.633 and 0.865 respectively). Factor 4 (Short-Term Liquidity II) was stable between 1993 and 1997 (correlation coefficient of 0.900). Factor 5 (Financial Leverage II) and Factor 6 (Decomposition Measure) were moderately stable between the two years (correlation coefficients of 0.604 and 0.732 respectively).

The correlation coefficients over the long-term (1989 with 1997) for Factor 1 (Return on Investment), Factor 2 (Short-Term Liquidity I), Factor 3 (Financial Leverage I), Factor 4 (Short-Term Liquidity II) and Factor 5 (Financial Leverage II) were stable (coefficients ≥ 0.894) between 1989 and 1997 (Table 28). Factor 6 (Decomposition Measure) displayed moderate stability between 1989 and 1997 (coefficient of 0.664).

Based on the above results, the revised financial ratio patterns were drafted (Table 29). The ratios in the factors had been rearranged based on the outcome of the correlation coefficients discussed above. In 1989, ratios loaded in Factor 4 had been moved into Factor 5, and ratios that previously loaded in Factor 5 had been moved into Factor 4. The swapping of ratios between the factors had been based on the comparability coefficients shown in Table 27.

Table 29

Revised Set of Financial Ratios and Ratio Loadings Defining Six Financial Ratio Patterns for Australian Industrial Firms: 1989, 1993, 1997

Ratio Number	Ratio Name	Ratio Loadings		
		1989	1993	1997

Factor 1 – Return on Investment

Ratio Number	Ratio Name	1989	1993	1997
13[a]	Earnings Before Interest & Tax/Total Assets	0.900	0.944	0.983
12[a]	EarningsBefore Interest & Tax/ Tangible Total Assets	0.894	0.942	0.949
14[a]	Operating Income/Operating Assets	0.878	0.870	0.846
16[a]	Funds From Operations/Total Liabilities	0.842	0.785	0.838
3[a]	Cash Flow Before Tax/Current Liabilities	0.841	0.827	0.786
21[a]	Net Profit After tax/Shareholders Funds	0.829	0.739	0.900
10[a]	Earnings Before Interest & Tax/Interest Expense	0.819	0.791	0.666
30[a]	Pretax Operating Income/Interest Expense	0.811	0.653	0.615
11[a]	Returns on Shareholders Funds	0.753	0.818	0.921

Factor 2 – Short-Term Liquidity I

Ratio Number	Ratio Name	1989	1993	1997
29[b]	Working Capital/Total Assets	0.978	0.439^{F3}	1.001
5[b]	Current Assets/Current Liabilities	0.954	0.187^{F3}	0.934
7[a]	Current Assets/Total Liabilities	0.810	0.498^{F3}	0.679
6[a]	Current Assets/Total Assets	0.799	0.905^{F3}	0.810
1[b]	Quick Ratio	0.716	0.031^{F3}	0.785
9[c]	Current Liabilities/Total Liabilities	- 0.049	0.592^{F3}	0.063

Factor 3 – Financial Leverage I

Ratio Number	Ratio Name	1989	1993	1997
25[a]	Shareholders Funds/Total Liabilities	0.896	0.882^{F2}	0.971
27[a]	Total Liabilities/Total Assets	-0.896	$- 0.832^{F2}$	-0.971
17[a]	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	0.719	0.629^{F2}	0.613
20[a]	Market Value of Equity/Total Liabilities	0.662	0.636^{F2}	0.743
29[c]	Working Capital/Total Assets	0.090	0.787^{F2}	0.038
5[c]	Current Assets/Current Liabilities	0.135	0.930^{F2}	0.213
7[c]	Current Assets/Total Liabilities	0.112	0.756^{F2}	0.300
1[c]	Quick Ratio	0.234	0.871^{F2}	0.217

Factor 4 – Short-Term Liquidity II

Ratio Number	Ratio Name	1989	1993	1997
23[a]	Quick Liabilities/Current Liabilities	0.628^{F5*}	0.850	0.686
18[a]	Cash/Current Assets	0.804^{F5*}	0.733	0.773
22[a]	Quick Assets/Current Assets	0.742^{F5*}	0.689	0.593

Ratio Number	Ratio Name	Ratio Loadings		
		1989	1993	1997
Factor 5 – Financial Leverage II				
9[a]	Current Liabilities/Total Liabilities	0.897^{F4}	0.456^{F6}	0.847
15[a]	Funded Debt (borrowings)/Shareholder Funds	-0.602^{F4}	-0.911^{F6}	-0.494
19[c]	Liabilities Decomposition Measure	0.226^{F4}	0.122^{F6}	0.474
Factor 6 – Decomposition Measure				
2[a]	Balance Sheet Decomposition Measure	0.729	0.555^{F5**}	0.799
4[a]	Asset Decomposition Measure	0.665	0.696^{F5**}	0.484
19[c]	Liabilities Decomposition Measure	0.610	0.437^{F5**}	0.049

Note.

[a] – Loaded at ≥ 0.450 or ≥ -0.450 in all three years.

[b] – Loaded at ≥ 0.450 or ≥ -0.450 in two of the years.

[c] – Loaded at ≥ 0.450 or ≥ -0.450 in only one year.

[F2] – Extracted ratios from Factor 2 in 1993 period moved into Factor 3.

[F3] – Extracted ratios from Factor 3 in 1993 period moved into Factor 2.

[F4] – Extracted ratios from Factor 4 in 1989 period moved into Factor 5.

[F5*] – Extracted ratios from Factor 5 in 1989 period moved into Factor 4.

[F5**] – Extracted ratios from Factor 5 in 1993 period moved into Factor 6.

[F6] – Extracted ratios from Factor 6 in 1993 period moved into Factor 5.

In 1993, ratios that loaded in Factor 2 were moved to Factor 3, and ratios that previously loaded in Factor 3 were moved to Factor 2. Similarly in the same period, ratios that loaded in Factor 5 were moved to Factor 6, and ratios that previously loaded in Factor 6 were moved into Factor 5. The swapping of ratios between the factors had been based on the comparability coefficients shown in Table 26.

Overall, the results in Table 29 showed improvement in the ratios that loaded on the factors over the one previously showed in Table 24. From 1989 to 1993, all the ratios that group under Factor 1 (<u>Return on Investment</u>) had consistently high loadings (i.e., ≥ 0.630 in absolute value) across the years, which indicated high stability. For Factor 2

(Short-Term Liquidity I), four of the six ratios had low loadings (i.e., ≤ 0.450 in absolute value) between the years, one ratio had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value) and the other ratio had high loading (i.e., ≥ 0.630 in absolute value). It showed that Factor 2 (Short-Term Liquidity I) was unstable. For Factor 3 (Financial Leverage I), half of the ratios loaded on the factor had high loadings (i.e., ≥ 0.630 in absolute value) and the other half had low loadings (i.e., ≤ 0.450 in absolute value) between 1989 and 1993. Therefore, overall Factor 3 (Financial Leverage I) was moderately stable. [54] Factor 4 (Short-Term Liquidity II) was highly stable because all but one of the ratios had high loadings (i.e., ≥ 0.630 in absolute value) between the years. [55] Two of the ratios loaded on Factor 5 (Financial Leverage II) had moderately high loadings (i.e., above 0.450 and below 0.630 in absolute value) between 1989 and 1993, and one had low loading (i.e., ≤ 0.450 in absolute value). It showed that Factor 5 (Financial Leverage II) was moderately stable. [56] One of the three ratios loaded on Factor 6 (Decomposition Measure) had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value), one had high loading (i.e., ≥ 0.630 in absolute value) and another had low loading (i.e., ≤ 0.450 in absolute value) between the years. Therefore, it showed that Factor 6 (Decomposition Measure) was moderately stable. [57]

---

[54] The ratios that loaded on Factor 3 were found to be unstable between 1989 and 1993 (Table 24).

[55] The ratios that loaded on Factor 4 were found to be unstable between 1989 and 1993 (Table 24).

[56] Factor 5 was unstable between 1989 and 1993 (Table 24).

[57] The ratios that loaded on Factor 6 were also found to be unstable across the years (Table 24).

For 1993 and 1997, Factor 1(Return on Investment) was found to be highly stable because all but one of the ratios had high loadings (i.e., ≥ 0.630 in absolute value) (Table 29). Factor 2 (Short-Term Liquidity I) was unstable because four of the six ratios had low loadings (i.e., ≤ 0.450 in absolute value), one had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value) and another had high loading (i.e., ≥ 0.630 in absolute value). For Factor 3 (Financial Leverage I), three of the eight ratios loaded on the factor had high loadings (i.e., ≥ 0.630 in absolute value), one had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value) and the other four had low loadings (i.e., ≤ 0.450 in absolute value). Therefore, overall Factor 3 (Financial Leverage I) was moderately stable.[58] Factor 4 (Short-Term Liquidity II) was highly stable because two of the three ratios had high loadings (i.e., $\geq$ 0.630 in absolute value) and the third ratio had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value) between the years.[59] For Factor 5 (Financial Leverage II), two of the three ratios had moderately high loadings (i.e., above 0.450 and below 0.630) and one had low loading (i.e., ≤ 0.450 in absolute value). It showed that Factor 5 (Financial Leverage II) was moderately stable.[60] Factor 6 (Decomposition Measure) was moderately stable because two of the three ratios had moderately high loadings (i.e., above 0.450 and below 0.630 in absolute value) and one ratio had low loading (i.e., ≤ 0.450 in absolute value) between 1993 and 1997.[61]

---

[58] The ratios loaded on Factor 3 were found to be unstable between 1993 and 1997 (Table 24).

[59] The ratios that loaded on Factor 4 were found to be moderately stable between 1993 and 1997 (Table 24).

[60] The ratios that loaded on Factor 5 were found to be unstable between 1993 and 1997 (Table 24).

[61] The ratios that loaded on Factor 6 were found to be unstable between 1993 and 1997 (Table 24).

For the long-term (1989 to 1997), Factor 1 (<u>Return on Investment</u>) was highly stable because all but one of the ratios had high loadings (i.e., ≥ 0.630 in absolute value) (Table 29). Factor 2 (<u>Short-Term Liquidity I</u>) was highly stable because five of the six ratios had high loadings (i.e., ≥ 0.630 in absolute value) and one ratio had low loading (i.e., ≤ 0.450 in absolute value) between the years.[62] For Factor 3 (<u>Financial Leverage I</u>), three of the eight ratios loaded on the factor had high loadings (i.e., ≥ 0.630 in absolute value), one had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value) and the remaining ratios had low loadings (i.e., ≤ 0.450 in absolute value). Therefore, overall Factor 3 (<u>Financial Leverage I</u>) was moderately stable. Factor 4 (<u>Short-Term Liquidity II</u>) was highly stable because one of the three ratios loaded on the factor had high loadings (i.e., ≥ 0.630 in absolute value) and two ratios had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value).[63] For Factor 5 (<u>Financial Leverage II</u>), one of the three ratios had high loading (i.e., ≥ 0.630 in absolute value), one had moderately high loading (i.e., above 0.450 and below 0.630 in absolute value), and the third one had low loading (i.e., ≤ 0.450 in absolute value). Therefore, overall Factor 5 (<u>Financial Leverage II</u>) was moderately stable.[64] One of the three ratios loaded on Factor 6 (<u>Decomposition Measure</u>) had high loading (i.e., ≥ 0.630 in absolute value), one had moderately high loading (i.e., above 0.450

---

[62] The ratios that loaded on Factor 2 were found to be moderately stable between 1989 and 1997 (Table 24).

[63] The ratios that loaded on Factor 4 were unstable between 1989 and 1997 (Table 24).

[64] The ratios that loaded on Factor 5 were unstable between 1989 and 1997 (Table 24).

and below 0.630 in absolute value), and a third ratio had low loading (i.e., ≤ 0.450 in absolute value). It showed that Factor 6 (Decomposition Measure) was moderately stable between the years.

According to Ezzamel et al. (1987), the results of the correlation coefficients could not capture changes in the magnitude of the ratio loadings. For example, Factor 3 (Financial Leverage I) showed a mixture of relatively moderate to high correlation coefficients (1989; 1993 = 0.826, 1993; 1997 = 0.865 and 1989; 1997 = 0.981) (Table 28) even though some of its absolute ratios loadings were moderately low for 1989, 1993 and 1997 (Table 29). Additional insight into the extent of the stability of the financial patterns may be gained by the calculation of "the percentage of absolute deviation in loadings to total absolute values" (Ezzamel et al., 1987, p. 528) for each factor and comparing 1989 with 1993; 1993 with 1997; and 1989 with 1997. It calculated the deviation on each ratio loading in the factor between the periods and aggregated all the differences of all the loadings in the factor. The results of this technique indicated the deviation in percentage between the two time periods. Thus, if the deviation of the factor was high, it indicated that the factor was unstable between the periods. For example, the percentage absolute deviation (PAD) for 1989 with 1993 (PAD 1989, 1993) was calculated as follows:

$$PAD = 1989, 1993 \quad \frac{\sum\limits_{i=1}^{N} (\beta^{ij}_{89} - \beta^{ij}_{93})}{\sum\limits_{i=1}^{N} (\beta^{ij}_{89})} \times 100$$

where β^{ij}_{89} and β^{ij}_{93} represented the loadings of ratio i on factor j for the years 1989 and 1993 respectively with N ratios loading on factor j.[65]

With reference to Ezzamel et al.'s (1987) study, the results of the percentage absolute deviation (PAD) reported in Table 30 indicates that in the short-term (1989 with 1993), Factor 1 (Return on Investment) was stable. Factor 2 (Short-Term Liquidity I) and Factor 3 (Financial Leverage I) were found to be unstable. Factor 4 (Short-Term Liquidity II) was moderately stable between the periods. Factor 5 (Financial Leverage II) was unstable. Factor 6 (Decomposition Measure) was found to be moderately stable.

---

[65] "In order to avoid the compensatory effects of negative and positive signs, once the difference was performed between the two years, the signs would be ignored (or absolute value) in summing the load deviations and the absolute value of the loadings" (Ezzamel et al., 1987, p. 528).

Table 30

The Percentage of Mean of Absolute Deviation to Mean of Absolute Values of Factor Loadings for Australian Industrial Firms: 1989 with 1993, 1993 with 1997, and 1989 with 1997

| | Factors | | | | | |
	1 ROI	2 STL I	3 FL I	4 STL II	5 FL II	6 DM
Years						
1989; 1993	6.729%	72.464%	151.998%	15.915%	163.916%	18.862%
1993; 1997	8.020%	108.223%	62.825%	13.204%	348.348%	50.000%
1989; 1997	10.762%	8.672%	34.426%	10.948%	77.927%	40.519%

Note.

Factors were defined as: ROI = Return on Investment; STL = Short-Term Liquidity I; FL I = Financial Leverage I; STL II = Short-Term Liquidity II; FL II = Financial Leverage II; DM = Decomposition Measure

For 1993 to 1997 period, Table 30 shows that Factor 1 (Return on Investment) was stable. Factor 2 (Short-Term Liquidity I) and Factor 3 (Financial Leverage I) were unstable between 1993 and 1997. Factor 4 (Short-Term Liquidity II) was found to be moderately stable between the periods. Factor 5 (Financial Leverage II) was unstable between 1993 and 1997. Factor 6 (Decomposition Measure) was moderately stable between 1993 and 1997.

In the long-term (1989 with 1997) (Table 30), Factor 1 (Return on Investment) and Factor 2 (Short-Term Liquidity I) were stable between 1989 and 1997. Factor 3 (Financial Leverage I) was moderately stable between 1989 and 1997. Factor 4 (Short-Term Liquidity II) was stable between the periods. Factor 5 (Financial Leverage II)

was found to be unstable. Finally, Factor 6 (<u>Decomposition Measure</u>) was moderately stable.

Further insights into the extent of the stability of the financial ratios could be examined by comparing the differences between the means of the raw data in all the three groups, 1989 and 1993, 1993 and 1997, and 1989 and 1997. T-test was used to test the significance of these differences. Table 31 reports the means and standard deviations of all the twenty six-ratios for 1989 and 1993. The results showed that all the ratios loaded on Factor 1 (<u>Return on Investment</u>), Factor 2 (<u>Short-Term Liquidity I</u>) and Factor 3 (<u>Financial Leverage I</u>) were not significantly different. Therefore, these factors may be stable between 1989 and 1993. Factor 4 (<u>Short-Term Liquidity II</u>) was moderately stable because all but one of the ratios were not significantly different. Factor 5 (<u>Financial Leverage II</u>) was stable because all the ratios were not significantly different in the short-term period. Factor 6 (<u>Decomposition Measure</u>) was moderately stable because two of the three ratios were not significantly different between 1989 and 1993.

Table 31

Means and Standard Deviations (Raw Data) for Australian Industrial Firms: 1989 with
1993

Ratio Number	Ratio Name	1989		1993	
		Mean	SD	Mean	SD
Factor 1 – Return on Investment					
13	Earnings Before Interest & Tax/Total Assets	-0.021	0.642	1.945	27.980
12	Earnings Before Interest & Tax/ Tangible Total Assets	-0.034	0.689	1.982	27.981
14	Operating Income/Operating Assets	-0.779	8.165	-1.327	50.777
16	Funds From Operations/Total Liabilities	-0.408	4.531	0.217	2.434
3	Cash Flow Before Tax/Current Liabilities	-0.270	4.867	0.337	2.716
21	Net Profit After tax/Shareholders Funds	-0.085	2.141	2.015	27.799
10	Earnings Before Interest & Tax/Interest Exp.	19.227	150.261	20.655	149.818
30	Pretax Operating Income/Interest Expense	19.136	149.955	18.311	126.468
11	Returns on Shareholders Funds	0.052	1.606	2.154	27.956
Factor 2 – Short-Term Liquidity I					
29	Working Capital/Total Assets	0.039	0.877	-0.048	1.860
5	Current Assets/Current Liabilities	2.673	6.117	4.438	24.289
7	Current Assets/Total Liabilities	2.018	5.788	3.787	24.331
6	Current Assets/Total Assets	0.419	0.232	0.437	0.242
1	Quick Ratio	2.373	6.227	4.377	24.735
9	Current Liabilities/Total Liabilities	0.679	0.258	0.652	0.277
Factor 3 – Financial Leverage I					
25	Shareholders Funds/Total Liabilities	4.000	13.372	6.700	43.939
27	Total Liabilities/Total Assets	0.567	0.924	0.702	1.943
17	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	1.354	4.837	1.141	2.652
20	Market Value of Equity/Total Liabilities	2.950	9.707	13.440	121.079
29	Working Capital/Total Assets	0.039	0.877	-0.048	1.855
5	Current Assets/Current Liabilities	0.267	6.112	4.438	24.289
7	Current Assets/Total Liabilities	2.018	5.788	3.787	24.332
1	Quick Ratio	2.373	6.227	4.377	24.735
Factor 4 – Short-Term Liquidity II					
23	Quick Liabilities/Current Liabilities	0.902	0.146	0.937	0.136*
18	Cash/Current Assets	0.162	0.233	0.158	0.225
22	Quick Assets/Current Assets	0.702	0.251	0.706	0.244

Ratio Number	Ratio Name	1989		1993	
		Mean	SD	Mean	SD
Factor 5 – Financial Leverage II					
9	Current Liabilities/Total Liabilities	0.678	0.258	0.654	0.277
15	Funded Debt (borrowings)/Shareholder Funds	0.123	0.635	0.374	1.901
Factor 6 – Decomposition Measure					
2	Balance Sheet Decomposition Measure	0.061	0.124	0.398	4.160
4	Asset Decomposition Measure	0.252	0.424	0.162	0.419*
19	Liabilities Decomposition Measure	0.256	0.470	0.222	0.606

Note.
* t-test between 1989 and 1993 significant at the 0.05 level.

Table 32 reports the means and standard deviations of the twenty-six ratios between 1993 and 1997. All the ratios loaded on Factor 1 (Return on Investment), Factor 2 (Short-Term Liquidity I) and Factor 3 (Financial Leverage I) were not significantly different. It indicated that these factors were relatively stable between 1993 and 1997. For Factor 4 (Short-Term Liquidity II), one of the three ratios showed a significant difference. This indicated that the factor was moderately stable. For Factor 5 (Financial Leverage II) and Factor 6 (Decomposition Measure), all the ratios were not significantly different. Therefore, the factors were stable between the periods.

Table 32

Means and Standard Deviations (Raw Data) for Australian Industrial Firms: 1993 with 1997

Ratio Number	Ratio Name	1993		1997	
		Mean	SD	Mean	SD
Factor 1 – Return on Investment					
13	Earnings Before Interest & Tax/Total Assets	1.945	27.980	0.008	0.250
12	Earnings Before Interest & Tax/ Tangible Total Assets	1.982	27.981	-0.015	0.460
14	Operating Income/Operating Assets	-1.327	50.777	-0.032	1.423
16	Funds From Operations/Total Liabilities	0.217	2.434	0.721	7.942
3	Cash Flow Before Tax/Current Liabilities	0.337	2.716	0.206	2.853
21	Net Profit After tax/Shareholders Funds	2.015	27.799	-0.016	0.451
10	Earnings Before Interest & Tax/Interest Exp.	20.654	149.818	-27.813	435.773
30	Pretax Operating Income/Interest Expense	18.311	126.468	-6.326	223.260
11	Returns on Shareholders Funds	2.154	27.956	0.048	0.477
Factor 2 – Short-Term Liquidity I					
29	Working Capital/Total Assets	-0.048	1.860	0.154	0.232
5	Current Assets/Current Liabilities	4.438	24.289	3.847	12.294
7	Current Assets/Total Liabilities	3.787	24.331	3.048	12.086
6	Current Assets/Total Assets	0.438	0.242	0.425	0.232
1	Quick Ratio	4.377	24.735	3.426	12.324
9	Current Liabilities/Total Liabilities	0.654	0.277	0.624	0.267
Factor 3 – Financial Leverage I					
25	Shareholders Funds/Total Liabilities	6.699	43.939	4.746	16.190
27	Total Liabilities/Total Assets	0.702	1.943	0.474	0.282
17	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	1.141	2.652	1.130	2.671
20	Market Value of Equity/Total Liabilities	13.441	121.079	8.798	42.285
29	Working Capital/Total Assets	-0.048	1.860	0.154	0.232
5	Current Assets/Current Liabilities	4.438	24.289	3.847	12.294
7	Current Assets/Total Liabilities	3.787	24.332	3.048	12.086
1	Quick Ratio	4.377	24.735	3.425	12.324

113

Ratio Number	Ratio Name	1993		1997	
		Mean	SD	Mean	SD
Factor 4 – Short-Term Liquidity II					
23	Quick Liabilities/Current Liabilities	0.937	0.136	0.965	0.088*
18	Cash/Current Assets	0.158	0.225	0.165	0.234
22	Quick Assets/Current Assets	0.706	0.244	0.733	0.222
Factor 5 – Financial Leverage II					
9	Current Liabilities/Total Liabilities	0.654	0.277	0.624	0.267
15	Funded Debt (borrowings)/Shareholder Funds	0.374	1.901	0.258	0.684
19	Liabilities Decomposition Measure	0.221	0.606	0.152	0.571
Factor 6 – Decomposition Measure					
2	Balance Sheet Decomposition Measure	0.398	4.160	0.056	0.230
4	Asset Decomposition Measure	0.162	0.419	0.128	0.372

Note.
* t-test between 1993 and 1997 significant at the 0.05 level.

Table 33 reports the means and standard deviations of all the twenty-six ratios for the long-term (1989 with 1997). The results indicated that there was no significant difference in the ratios loaded on Factor 1 (Return on Investment), Factor 2 (Short-Term Liquidity I), and Factor 3 (Financial Leverage I). This meant that these financial patterns remained stable between 1989 and 1997. For Factor 4 (Short-Term Liquidity II), two of the three ratios showed no significant difference, indicating that the factor was moderately stable. All the ratios loaded on Factor 5 (Financial Leverage II) were significantly different (p = 0.05). Two of the three ratios loaded on Factor 6 (Decomposition Measure) were also significantly different (p = 0.05). Therefore, Factor 5 (Financial Leverage II) and Factor 6 (Decomposition Measure) were unstable between 1989 and 1997.

114

Table 33

Means and Standard Deviations (Raw Data) for Australian Industrial Firms: 1989 with 1997

Ratio Number	Ratio Name	1989		1997	
		Mean	SD	Mean	SD
Factor 1 – Return on Investment					
13	Earnings Before Interest & Tax/Total Assets	-0.021	0.642	0.008	0.250
12	Earnings Before Interest & Tax/ Tangible Total Assets	-0.033	0.689	-0.015	0.460
14	Operating Income/Operating Assets	-0.779	8.165	-0.032	1.425
16	Funds From Operations/Total Liabilities	-0.408	4.531	0.721	7.942
3	Cash Flow Before Tax/Current Liabilities	-0.270	4.867	0.206	2.853
21	Net Profit After tax/Shareholders Funds	-0.085	2.141	-0.016	0.451
10	Earnings Before Interest & Tax/Interest Exp.	19.227	150.261	-27.813	435.773
30	Pretax Operating Income/Interest Expense	19.136	149.955	-6.326	223.260
11	Returns on Shareholders Funds	0.052	1.606	0.048	0.477
Factor 2 – Short-Term Liquidity I					
29	Working Capital/Total Assets	0.039	0.877	0.154	0.232
5	Current Assets/Current Liabilities	2.673	6.117	3.847	12.294
7	Current Assets/Total Liabilities	2.018	5.788	3.048	12.086
6	Current Assets/Total Assets	0.419	0.232	0.425	0.232
1	Quick Ratio	2.337	6.226	3.426	12.324
Factor 3 – Financial Leverage I					
25	Shareholders Funds/Total Liabilities	3.996	13.373	4.746	16.190
27	Total Liabilities/Total Assets	0.567	0.924	0.474	0.282
17	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	1.354	4.837	1.130	2.671
20	Market Value of Equity/Total Liabilities	2.950	9.707	8.798	42.285
Factor 4 – Short-Term Liquidity II					
23	Quick Liabilities/Current Liabilities	0.902	0.146	0.965	0.088**
18	Cash/Current Assets	0.161	0.233	0.165	0.234
22	Quick Assets/Current Asset	0.702	0.251	0.733	0.222

Ratio Number	Ratio Name	1989		1997	
		Mean	SD	Mean	SD
Factor 5 – Financial Leverage II					
9	Current Liabilities/Total Liabilities	0.678	0.258	0.624	0.267*
15	Funded Debt (borrowings)/Shareholder Funds	0.123	0.635	0.258	0.684*
19	Liabilities Decomposition Measure	0.256	0.470	0.152	0.571*
Factor 6 – Decomposition Measure					
2	Balance Sheet Decomposition Measure	0.062	0.124	0.056	0.230
4	Asset Decomposition Measure	0.252	0.424	0.128	0.372*
19	Liabilities Decomposition Measure	0.256	0.470	0.152	0.571*

Note.
* t-test between 1989 and 1997 significant at the 0.05 level.
** t-test between 1989 and 1997 significant at the 0.001 level.

The final test of stability was a differential factor analysis on the differences in ratios for 1989 with 1993, 1993 with 1997, and 1989 with 1997. The operation of the differential factor analysis technique involved two steps (Cattell, 1952). First, a standardised difference matrix was calculated, taking two static time positions (e.g. 1989 and 1997) to produce a positional change matrix. Second, factor analysis (principal components analysis with promax rotation) was performed on the positional change matrix. Ratios that experienced similar degrees of change between the two periods would load in the same factor. Thus, if the differential loadings were high for all the ratios in a factor, it indicated the stability of the financial pattern between the two periods for all firms in the sample. Conversely, low differential loadings implied dissimilar changes in the financial pattern for the firms between the two periods.

The swapping of the ratios between the factors were based on the characteristics of each factor following the differential factor analysis (Table 34). For 1989 and 1993,

116

the ratios that originally loaded in Factor 4 (Financial Leverage I) had moved to Factor

3. Similarly, the ratios that originally loaded in Factor 3 (Short-Term Liquidity II) had

moved to Factor 4. The ratios that originally grouped under Factor 6 (Financial

Leverage II) had moved to Factor 5. The ratios that originally loaded in Factor 5

(Decomposition Measure) had moved to Factor 6 in Table 34.

Table 34

Differential Factor Analysis of 1989 with 1993, 1993 with 1997, and 1989 with 1997

Ratio Number	Ratio Name	Differential Factor Loadings		
		1989-1993	1993-1997	1989-1997

Factor 1 – Return on Investment

13	Earnings Before Interest & Tax/Total Assets	0.906	0.956	0.903
12	EarningsBefore Interest & Tax/			
	Tangible Total Assets	0.905	0.967	0.920
14	Operating Income/Operating Assets	0.858	0.851	0.921
16	Funds From Operations/Total Liabilities	0.801	0.859	0.844
3	Cash Flow Before Tax/Current Liabilities	0.823	0.876	0.850
21	Net Profit After tax/Shareholders Funds	0.907	0.857	0.719
10	Earnings Before Interest & Tax/Interest Expense	0.818	0.470	0.820
30	Pretax Operating Income/Interest Expense	0.721	0.214	0.755
11	Returns on Shareholders Funds	0.845	0.895	0.727

Factor 2 – Short-Term Liquidity I

29	Working Capital/Total Assets	0.956	0.892	0.903
5	Current Assets/Current Liabilities	0.929	0.760	0.910
7	Current Assets/Total Liabilities	0.855	0.659	0.616
6	Current Assets/Total Assets	0.236	0.974	0.669
1	Quick Ratio	0.829	0.720	0.891
9	Current Liabilities/Total Liabilities	- 0.058	0.150	- 0.190

Ratio Number	Ratio Name	Differential Factor Loadings		
		1989-1993	1993-1997	1989-1997

Factor 3 – Financial Leverage I

Ratio Number	Ratio Name	1989-1993	1993-1997	1989-1997
25	Shareholders Funds/Total Liabilities	-0.361^{F4}	0.912	0.931
27	Total Liabilities/Total Assets	0.284^{F4}	-0.879	-0.931
17	Absolute Value of Income Before Tax, Interest & Depreciation/(Current Liabilities – Overdrafts)	-0.661^{F4}	0.404	0.494
20	Market Value of Equity/Total Liabilities	-0.180^{F4}	0.693	0.734
29	Working Capital/Total Assets	0.240^{F4}	0.156	0.135
5	Current Assets/Current Liabilities	0.098^{F4}	0.302	0.150
7	Current Assets/Total Liabilities	0.334^{F4}	0.381	0.337
1	Quick Ratio	0.028^{F4}	0.267	0.897

Factor 4 – Short-Term Liquidity II

Ratio Number	Ratio Name	1989-1993	1993-1997	1989-1997
23	Quick Liabilities/Current Liabilities	0.516^{F3}	0.706	0.427^{F5*}
18	Cash/Current Assets	-0.800^{F3}	0.723	-0.718^{F5*}
22	Quick Assets/Current Assets	-0.848^{F3}	0.708	-0.625^{F5*}

Factor 5 – Financial Leverage II

Ratio Number	Ratio Name	1989-1993	1993-1997	1989-1997
9	Current Liabilities/Total Liabilities	0.884^{F6}	0.799	0.446^{F6*}
15	Funded Debt (borrowings)/Shareholder Funds	-0.201^{F6}	-0.589	-0.819^{F6*}
19	Liabilities Decomposition Measure	0.197^{F6}	0.497	0.115^{F6*}

Factor 6 – Decomposition Measure

Ratio Number	Ratio Name	1989-1993	1993-1997	1989-1997
2	Balance Sheet Decomposition Measure	0.391^{F5}	-0.567	0.612^{F4*}
4	Asset Decomposition Measure	-0.520^{F5}	-0.473	0.591^{F4*}
19	Liabilities Decomposition Measure	-0.614^{F5}	-0.268	0.192^{F4*}

Note.

^{F3} – Extracted ratios from Factor 3 between 1989 and 1993 moved into Factor 4.
^{F4} – Extracted ratios from Factor 4 between 1989 and 1993 moved into Factor 3.
^{F6} – Extracted ratios from Factor 6 between 1989 and 1993 moved into Factor 5.
^{F5} – Extracted ratios from Factor 5 between 1989 and 1993 moved into Factor 6.
^{F4*} – Extracted ratios from Factor 4 between 1989 and 1997 moved into Factor 6.
^{F5*} – Extracted ratios from Factor 5 between 1989 and 1997 moved into Factor 4.
^{F6*} – Extracted ratios from Factor 6 between 1989 and 1997 moved into Factor 5.

For 1989 and 1997, the ratios that were originally extracted in Factor 5 (Short-Term Liquidity II) had moved to Factor 4 (Table 34). Similarly, the ratios found in Factor 6

(Financial Leverage II) had moved to Factor 5. The ratios that were originally extracted in Factor 4 (Decomposition Measure) had moved to Factor 6.

For the short-term period (1989 to 1993), Factor 1 (Return on Investment) had high differential loadings (i.e., ≥ 0.630 in absolute value) for all the ratios (Table 34). It indicated that the firms in the sample shared overall stability in Return on Investment. Factor 2 (Short-Term Liquidity I) also had high differential loadings (i.e., ≥ 0.630 in absolute value) for four of the six ratios and two ratios had low differential loadings (i.e., ≤ 0.450 in absolute value). Overall, Factor 2 (Short-Term Liquidity I) was moderately stable. For Factor 3 (Financial Leverage I), seven of the eight ratios had low differential loadings (i.e., ≤ 0.450 in absolute value) and one had high differential loading (i.e., ≥ 0.630 in absolute value). It indicated that Factor 3 (Financial Leverage I) was unstable. Factor 4 (Short-Term Liquidity II) was highly stable because two ratios had high differential loadings (i.e., ≥ 0.630 in absolute value) and one ratio had moderately high differential loading (i.e., above 0.450 and below 0.630 in absolute value) between the years. Factor 5 (Financial Leverage II) was unstable because two of the three ratios had low differential loadings (i.e., ≤ 0.450 in absolute value) and the third ratio had high differential loading (i.e., ≥ 0.630 in absolute value). Factor 6 (Decomposition Measure) was moderately stable because two ratios had moderate differential loadings (i.e., above 0.450 and below 0.630 in absolute value) and a third ratio had low differential loading (i.e, ≤ 0.450 in absolute value).

For 1993 to 1997, Factor 1 (Return on Investment) had high differential loadings (i.e., ≥ 0.630 in absolute value) for seven of the nine ratios, one had moderately high differential loading (i.e., above 0.450 and below 0.630 in absolute value) and another had low differential loading (i.e., ≤ 0.450 in absolute value) (Table 34). Therefore, overall, Factor 1 (Return on Investment) was highly stable. Factor 2 (Short-Term Liquidity I) had high differential loadings (i.e., ≥ 0.630 in absolute value) for five of the six ratios and one had low differential loading (i.e., ≤ 0.450 in absolute value). It showed that Factor 2 (Short-Term Liquidity I) was highly stable. For Factor 3 (Financial Leverage I), five of the eight ratios had low differential loadings (i.e., ≤ 0.450 in absolute value) and the remaining ratios had high differential loadings (i.e., ≥ 0.630 in absolute value). It indicated that Factor 3 (Financial Leverage I) was not stable. Factor 4 (Short-Term Liquidity II) had high differential loadings (i.e., ≥ 0.630 in absolute value) for all of the ratios, indicating that the factor was highly stable. Factor 5 (Financial Leverage II) had one ratio that had high differential loading (i.e., ≥ 0.630 in absolute value) and the other two ratios had moderate differential loadings (i.e., above 0.450 and less than 0.630 in absolute value). It showed that Factor 5 (Financial Leverage II) was moderately stable. Factor 6 (Decomposition Measure) had moderately high differential loadings (i.e., above 0.450 and less than 0.630 in absolute value) for two of the three ratios and one had low differential loading (i.e., ≤ 0.450 in absolute value). It indicated that overall Factor 6 (Decomposition Measure) was moderately stable.

For the long-term (1989 to 1997), Factor 1 (Return on Investment) was highly stable because it had high differential loadings (i.e., ≥ 0.630 in absolute value) for all the ratios (Table 34). Factor 2 (Short-Term Liquidity I) had high differential loadings (i.e., ≥ 0.630 in absolute value) for four of the six ratios, one had moderately high differential loading (i.e., above 0.450 and below 0.630 in absolute value) and another had low differential loading (i.e., ≤ 0.450 in absolute value). Therefore, it showed that Factor 2 (Short-term Liquidity I) was moderately stable. For Factor 3 (Financial Leverage I), four of the eight ratios had high differential loadings (i.e., ≥ 0.630 in absolute value), one had moderately high differential loading (i.e., above 0.450 and below 0.630 in absolute value), and the remaining ratios had low differential loadings (i.e., ≤ 0.450 in absolute value). It indicated that overall, Factor 3 (Financial Leverage I) was moderately stable. For Factor 4 (Short-Term Liquidity II), one of the three ratios had moderately high differential loadings (i.e., above 0.450 and less than 0.630 in absolute value), one had high differential loading (i.e., ≥ 0.630 in absolute value) and another had low differential loading (i.e., ≤ 0.450 in absolute value). It showed that Factor 4 (Short-Term Liquidity II) was moderately stable. For Factor 5 (Financial Leverage II), two ratios had low differential loadings (i.e., ≤ 0.450 in absolute value) and one had high differential loading (i.e., ≥ 0.630 in absolute value). It showed that Factor 5 (Financial Leverage II) was unstable between 1989 and 1997. Last, Factor 6 (Decomposition Measure) was moderately stable because two ratios had moderately high differential loading (i.e., above 0.450 and less than 0.630 in absolute value) and the third one had low differential loading (i.e., ≤ 0.450 in absolute value).

Table 35 summarises all the tests of temporal stability for both the short-term and long-term. For the short-term (1989 and 1993), Factor 1 (<u>Return on Investment</u>) showed stability in all the tests (the ratios loading on the factor (Table 29), the correlation coefficients of the factor loadings (Table 28), the percentage of absolute deviation of the factor loadings (Table 30), the t-tests of the differences between the means (Table 31) and the differential factor loadings (Table 34).[66] Factor 2 (<u>Short-Term Liquidity I</u>) demonstrated high stability in the t-tests of the differences between the means, moderate stability in the correlation coefficients of the factor loadings and the differential factor loadings, and instability in the ratio loadings on the factor and the percentage of absolute deviation of the factor loadings. Factor 3 (<u>Financial Leverage I</u>) showed high stability in the t-tests of the differences between the means, moderate stability in the ratios loading on the factor and the correlation coefficients of the factor loadings, and instability in the percentage of absolute deviation of the factor loadings and the differential factor loadings. Factor 4 (<u>Short-Term Liquidity II</u>) showed high stability in the ratios loading on the factor and the differential factor loadings, and moderate stability for the remaining tests (the correlation coefficients of the factor loadings, the percentage of absolute deviation of the factor loadings and the t-tests of the differences between the means). Factor 5 (<u>Financial Leverage II</u>) showed high stability in the t-tests of the differences between the means, moderate stability in the ratios loading on the factor and the correlation coefficients of the factor loadings and instability in the percentage of absolute deviation of factor loadings and the differential factor loadings. Factor 6 (<u>Decomposition Measure</u>) demonstrated moderate

---

[66] The results from the t-test were less consistent with the results from the other tests because the t-tests were performed on the raw data.

stability in all the tests (the ratios loading on the factor, the correlation coefficients of the factor loadings, the percentage of absolute deviation of the factor loadings, the t-tests of the differences between the means and the differential factor loadings).

Table 35

Summary Of All The Tests of Temporal Stability For Both The Short-Term and Long-Term

Factor number and name	Short- Term 1989 - 1993					Short-Term 1993 – 1997					Long-Term 1989 - 1997				
	FL	CC	PAD	T-tests[a]	DL	FL	CC	PAD	T-tests[a]	DL	FL	CC	PAD	T-tests[a]	DL
1 Return on Investment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Short-Term Liquidity I	2	1	2	0	1	2	1	2	0	0	0	0	0	0	1
3 Financial Leverage I	1	1	2	0	2	1	1	2	0	2	1	0	1	0	1
4 Short-Term Liquidity II	0	1	1	1	0	0	0	1	1	0	0	0	0	1	1
5 Financial Leverage II	1	1	2	0	2	1	1	2	0	1	1	0	2	2	2
6 Decomposition Measure	1	1	1	1	1	1	1	1	0	1	1	1	1	2	1

Note.

FL – Ratio loadings on the Factor
CC – Correlations Coefficients of the Factor Loadings
PAD – Percentage Absolute Deviation of the Factor Loadings
T-tests – T-tests for the Differences in Means
DL – Differential Factor Loadings
[a] – The t-tests results were less consistent with the results of the other tests because the t-tests were performed on the raw data.
0 denotes high stability
1 denotes moderate stability
2 denotes instability

For 1993 and 1997, Factor 1 (Return on Investment) demonstrated stability in all the tests (the ratio loadings on the factor (Table 29), the correlation coefficients of the factor loadings (Table 28), the percentage of absolute deviation of the factor loadings (Table 30), the t-tests of the differences between the means (Table 32) and the differential factor loadings (Table 34)) (Table 35). Factor 2 (Short-Term Liquidity I) reported high stability in the t-tests of the differences between the means and the differential factor loadings, moderate stability in the correlation coefficients of the factor loadings, and instability in the ratio loadings on the factor and the percentage of absolute deviation of the factor loadings. Factor 3 (Financial Leverage I) demonstrated high stability in the t-tests of the differences between the means, moderate stability in the ratios loading on the factor and the correlation coefficients of the factor loadings, and instability in the percentage of absolute deviation of the factor loadings and the differential factor loadings. Factor 4 (Short-Term Liquidity II) reported high stability in the ratios loading on the factor, the correlation coefficients of the factor loadings and the differential factor loadings, and moderate stability in the percentage of absolute deviation of the factor loadings and the t-tests of the differences between the means. Factor 5 (Financial Leverage I) reported high stability in the t-tests, moderate stability in ratios loading on the factor, the correlation coefficients of the factor loadings and the differential factor loadings, and instability in the percentage of absolute deviation of the factor loadings. Factor 6 (Decomposition Measure) reported high stability in the t-tests of the differences between the means, and moderate stability in the remaining tests (the ratios loading on the factor, the correlation coefficients of the factor loadings, the percentage of absolute deviation of the factor loadings, and the differential factor loadings).

For the long-term (1989 and 1997), Factor 1 (Return on Investment) was found to be stable in all the tests (the ratios loading on the factor (Table 29), the correlation coefficients of the factor loadings (Table 28), the percentage of absolute deviation of the factor loadings (Table 30), the t-tests of the differences between the means (Table 33) and the differential factor loadings (Table 34)) (Table 35). Factor 2 (Short-Term Liquidity I) reported high stability in all the tests, except one (the differential factor loadings showed that it was moderately stable). Factor 3 (Financial Leverage I) showed high stability in the correlation coefficients of the factor loadings and the t-tests of the differences between the means, moderate stability in the remaining tests (the ratios loading on the factor, the percentage of absolute deviation of the factor loadings and the differential factor loadings). Factor 4 (Short-Term Liquidity II) was found to be highly stable in the ratios loading on the factor, the correlation coefficient of the factor loadings and the percentage of absolute deviation of the factor loadings, and moderate stability in the remaining tests (the t-tests of the differences between the means and the differential factor loadings). Factor 5 (Financial Leverage II) was found to have high stability in the correlation coefficient of the factor loadings, moderate stability in the ratios loading on the factor, and instability in the rest of the tests (the percentage of absolute deviation of the factor loadings, the t-tests of the differences between the means and the differential factor loadings). Factor 6 (Decomposition Measure) was found to be moderately stable in the ratios loading on the factor, the correlation coefficients of the factor loadings, the percentage of absolute deviation of the factor loadings and the differential factor loadings, and unstable in the t-tests of the differences between the means.

Conclusion

A set of thirty-one financial ratios and 199 randomly selected Australian Industrial firms were used in the analyses. The ratios were examined for normality and degree of correlation in all the three years (1989, 1993 and 1997) to justify the application of factor analysis. The results showed that the distributions of all the ratios, apart from one, departed severely from normal. These ratios were normalised using the LISREL (Linear Structural RELations) program. The thirty-one ratios were then subjected to a factor analysis (principal components analysis with PROMAX rotation). Following this, five ratios with low factor loadings were dropped. The with-in group factor comparability test was performed on the pooled data to derive a set of six factors. The between-group factor comparability test was performed for each of the individual years (1989, 1993 and 1997).

The extent of stability of the six financial patterns (<u>Return on Investment</u>, <u>Short-Term Liquidity I</u>, <u>Financial Leverage I</u>, <u>Short-Term Liquidity II</u>, <u>Financial Leverage II</u> and <u>Decomposition Measure</u>) were determined by (a) the ratios that loaded on the factors; (b) the correlation coefficient of the loadings on each factor; (c) calculating the percentage of absolute deviation in loadings for each factor; (d) calculating the t-statistics of the differences between the means of the raw data; and (e) performing differential factor analysis on the ratios. The results showed that <u>Return on Investment</u> was stable and the rest of the factors demonstrated a combination of moderate and low stability.

The next chapter would conclude the study by discussing the findings of the study,

limitations of the study, and lastly, implications and future research.

CHAPTER SIX

Conclusions

Introduction

The purposes of this study were, first, to examine the financial patterns of Australian

industrial firms along the lines of Pinches et al.'s (1973; 1975). Second, the present

study examined only financial ratios used in prior Australian corporate failure

prediction studies in an attempt to derive a reduced set of factors that was predictive of

corporate failure (Castagna & Matolcsy, 1981; Booth, 1983; Izan, 1984; Lincoln,

1984; McNamara et al., 1988; Shailer, 1990; Constable & Woodliff, 1994). Third, the

study examined the short- and long-term stability of these factors.

Prior studies (Pinches et al., 1973; 1975; Johnson, 1978; 1979; Taffler & Sudarsanam,

1979; Laurent, 1979; Ezzamel et al., 1987) had empirically classified financial ratios

into several distinct factors. A total of 13 factors were suggested with each study

seemingly proposing a different set of factors. These studies derived factors that were

useful in evaluating the overall financial state of a firm. In contrast, one of the

motivations of this study was to identify a set of factors that is relevant to the

prediction of corporate failure.

Pinches et al. (1975) found that the financial patterns of US industrial firms over the

short-term (1966 – 1969) to be relatively stable. Pinches et al. (1973) also found the

financial patterns of these firms to be reasonably stable over the long term (1951 –

1969) with the exception of two factors (Receivables Intensiveness and Capital

<u>Intensiveness</u>). The financial patterns of the UK manufacturing firms were generally

unstable over the period 1973 to 1981 (Ezzamel et al., 1987). Hence, more research

was needed to examine the stability of the financial patterns, particularly in the

Australian context, since the results of prior studies may not be generalisable to

Australia.

The multivariate statistical technique of factor analysis was employed in the present

study. A sample of 199 firms was randomly selected from the FINSELECT database

covering the period from 1989 to 1997. Only industrial firms registered in Australia

were included in the sample.

<div align="center"><u>Findings of the Study</u></div>

The first research question of this study asked:

Q1 – Can the factors that predict corporate failure be classified into <u>Return on</u>

  <u>Investment</u>, <u>Liquidity</u>, <u>Leverage</u> and <u>Decomposition Measure</u> dimensions?

Factor analysis indicated that the factors were sufficiently differentiated. However, by

examining the ratios clustering in each factor, it could be argued that there exist four

broad areas that were useful predictors of corporate failure. These were <u>Return on</u>

<u>Investment</u>, <u>Short-Term Liquidity (I and II)</u>, <u>Financial Leverage (I and II)</u> and

<u>Decomposition Measure</u>. These six first-order classifications, through the use of

higher-order factor analysis, were interrelated. The three higher-order factors –

<div align="center">130</div>

<u>Liquidity I</u>, <u>Liquidity II</u>, and <u>Return on Invested Capital</u> were found to provide a more comprehensive grouping of financial ratios because they specified the interrelationships among financial ratios and the first-order factors.

The proportions of the total variance explained by the extracted factors (74.551% in 1989, 74.003% in 1993 and 74.580% in 1997) were relatively smaller as compared to those reported in previous studies (ranging from 66% to 76% in Ezzamel et al., 1987; 86% in Johnson, 1978; 1979; ranging from 87% to 93% in Pinches et al., 1973; 1975; and 93% in Taffler & Sudarsanam, 1979). These differences might be due to different sample sizes, year of study, country of study or original set of ratios used. For example, prior studies like Pinches et al. (1973; 1975), Johnson (1978; 1979) were carried out in the United States, Laurent (1979) in Hong Kong, Taffler and Sudarsanam (1979) and Ezzamel et al. (1987) in the United Kingdom. Despite this, all four factors extracted in this study had been previously identified by all the prior studies: <u>Return on Investment</u>, <u>Financial Leverage</u>, <u>Short-Term Liquidity</u>, and the <u>Decomposition Measure</u>.

In terms of the order of the factors, <u>Return on Investment</u> was the most dominant factor identified in this study. This was consistent with all prior studies with the exception of Ezzamel et al. (1987). <u>Short-Term Liquidity</u> was the second and fourth factors identified in this study. There were mixed results in the order of this factor in prior studies (sixth factor in Pinches et al., 1973; 1975; and Laurent, 1979; seventh factor in Johnson, 1978; 1979; fifth factor in Taffler & Sudarsanam, 1979; and fourth and tenth factors in Ezzamel et al., 1987). <u>Financial Leverage</u> was the third and fifth

factors identified in this study. It was the fourth factor in Pinches et al. (1973; 1975), second factor in Johnson (1978; 1979) and Taffler and Sudarsanam (1979), second and fifth factors in Laurent (1979), and fifth factor in Ezzamel et al. (1987). The final factor identified in this study was <u>Decomposition Measure</u>. Apart from Johnson (1978; 1979) (eighth factor), no prior studies had identified this factor. Overall, there was disparity in the order of the factors found in all these studies including the present one. Even for the same country (e.g., Pinches et al., 1973; 1975 and Johnson, 1978; 1979 in the United States, Taffler & Sudarsanam, 1979 and Ezzamel et al., 1987 in the United Kingdom), they appeared to be different. Thus, it might suggest that the order of the factors appeared to be dependent upon the precise nature of the sample used.

The second research question of this study was:

Q2 – Are the <u>Return on Investment, Liquidity, Leverage</u> and <u>Decomposition Measure</u> factors stable over the short- and long-term?

The study observed some instability of the financial patterns over the period 1989 – 1993. Examination into the extent of stability of the financial patterns over a period of time were based on the ratios that loaded in each factor, the correlation coefficients of the factor loadings, the percentage of absolute deviation of the factor loadings, t-tests of the differences between the means of the raw data, and the differential factor loadings. In the short-term (1989 and 1993), Factor 1 (<u>Return on Investment</u>) was the most stable factor. Factor 2 (<u>Short-Term Liquidity I</u>) and Factor 3 (<u>Financial Leverage I</u>) were unstable. Factor 4 (<u>Short-Term Liquidity II</u>) showed moderate stability. Factor

5 (Financial Leverage II) was unstable. Factor 6 (Decomposition Measure) was moderately stable.

For 1993 and 1997, Factor 1 (Return on Investment) was the most stable factor. Factor 2 (Short-Term Liquidity I), Factor 3 (Financial Leverage I) and Factor 5 (Financial Leverage II) were unstable between the periods. Factor 4 (Short-Term Liquidity II) and Factor 6 (Decomposition Measure) showed moderate stability.

Over the long-term (1989 and 1997), Factor 1 (Return on Investment) was the most stable factor. Factor 2 (Short-Term Liquidity I), Factor 3 (Financial Leverage I) and Factor 4 (Short-Term Liquidity II) showed moderate stability between 1989 and 1997. Factor 5 (Financial Leverage II) showed instability. Factor 6 (Decomposition Measure) was moderately stable.

Discussion

The present study observed only four factors, in contrast to prior studies (see Table 3. There were three possible reasons for that, first, the present study focussed on corporate failure prediction only. The ratios used in the present study were based on prior Australian corporate failure studies. In contrast, other studies (like Pinches et al., 1973; 1975) had chosen ratios based on the usefulness and popularity. Second, the type of ratios used in the present study was different to prior studies. For example, in Pinches et al.'s (1973; 1975) studies, there were ratios (e.g., "receivables to inventory", "receivables to sales", "quick assets to sales") that measure Receivables

Intensiveness. In Laurent's (1979) study, there were ratios (e.g., "reserves to net income", "dividend to net income") that measure Income Retention. Those ratios were not included in prior Australian corporate failure prediction studies. Third, the number of ratios used in the present study was the smallest compared to prior studies. For example, Pinches et al. (1973; 1975) used 48 ratios, Johnson (1978; 1979) used 61 ratios and Taffler and Sudarsanam (1979) used 80 ratios in their studies. The 31 ratios used in the present study comprised the population of unique ratios used in prior corporate failure studies in Australia.

The results relating to the stability of the financial patterns reported here were considerably less stable compared to the financial patterns reported in Pinches et al. (1973; 1975). There were few possible reasons. First, it could be attributed to the differences in institutional and economic backgrounds of the two samples. The differences in these backgrounds between Australian firms and firms from other countries (e.g., United States) may have a significant impact on the computation of financial ratios. For example, Australian standard, unlike the United States standard does not permit the use of LIFO (last-in, first-out) method of accounting for inventories (Australian Accounting Standards Board [AASB], 1996, para. 30). Second, changes in inflation, interest rates and/or phases of business cycle may be responsible for data instability between the years (Platt & Platt, 1990). For example, in times of price changes and inflation, the consistent application of historical cost in the preparation of the financial statements may result of the instability of the financial ratios between the years.

134

In this study, <u>Short-Term Liquidity I</u> appeared to be unstable over both the short-term periods (1989 and 1993, 1993 and 1997). This could be due primarily to the increased of short-term debt to finance the expansion of the firm business (Mensah, 1984). Similar reasoning also applied to the instability of some of the financial patterns in the long-term. For example, the instability of <u>Decomposition Measure</u> could also be a result of the change in structure of a firm in the long-term. In addition, the instability of the factor could also be attributable to changes in the business cycle and technology.

Limitations

There were four limitations to this study. First, the sample chosen excluded financial institutions and mining firms. Hence, the results of this study could only be generalised to industrial firms. Second, the number of ratios used in this study was limited because there was only a few corporate failure prediction studies in Australia. Third, the generalisability of the results of the present study is dependent upon the generalisability of the corporate failure prediction models derived in prior studies. Fourth, the technique used in selecting the firms for inclusion in the data set is likely to introduce a survival bias, thereby limiting the usefulness of the results (Ezzamel et al., 1987).

Implications

Evidence from this study had important implications for the decision-makers. The results indicated that financial ratios relating to corporate failure could be distinctly

classified into four factors, namely – <u>Return on Investment</u>, <u>Short-Term Liquidity</u>, <u>Financial Leverage</u> and <u>Decomposition Measure</u>. Each of the factors represented different aspects of a firm's operations. Decision-makers could use these results to analyse a firm's financial position with regard to its ability to survive. This study could also be of value to researchers wishing to derive a corporate failure prediction model. They could select a ratio or a few ratios from each of the factors to derive a discriminant function to predict failure. The essential attribute of a successful corporate failure model is the stability of its explanatory financial ratios over time (Dambolena & Khoury, 1980; Betts & Belhoul, 1987). Instability of the financial ratios may lead to less accuracy in classifying failed and non-failed firms (Dambolena & Khoury, 1980). Caution should therefore be exercised in applying the model derived from this study as some of the factors were found to be unstable.

<u>Future Research</u>

Future studies could empirically classified financial ratios for financial institutions or mining firms (resource sector). These two sectors might provide empirical evidence on whether the industrial sector has the same financial patterns as compared to either the financial or resource sectors.

The number of the ratios used in the present study was small because there was only a handful of corporate failure studies that related to Australia. In contrast, other studies (like Ezzamel et al., 1987) had found a list of 152 ratios (i.e., based on its usefulness and popularity reflected in the literature) (53 ratios were used in their analysis). It was

unclear whether prior Australian studies had captured the most predictive ratios.

Therefore, future research to develop more comprehensive Australian corporate failure

prediction models should be encouraged.

REFERENCES

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance*, 23 (4), 589-609.

Altman, E. I. (1983). *Corporate financial distress*. John Wiley & Sons.

Altman, E. I. (1984). The success of business failure prediction models: An international survey. *Journal of Banking and Finance*, 8 (2), 171-198.

Altman, E. I., Haldeman, R. G., & Narayanan, P. (1977). Zeta analysis: A new model to identify bankruptcy risk of corporation. *Journal of Banking and Finance*, 1 (2), 29-54.

Altman, E. I., & Izan, H. Y. (1981). *Research in progress*. Australian Graduate School of Management, Sydney.

Anonymous (1997). *The Australian Economy*. Euromoney Publications PLC, London, (Dec), 2-3.

Australian Accounting Research Foundation [AARF], Auditing Standards Board [ASB]. (1996). *Exposure Draft ED 63: Additional disclosures by financial institutions*. Caulfield, Vic: Australian Accounting Research Foundation.

Australian Accounting Standards Board [AASB]. (1996). *Accounting Standard AASB 1019: Measurement and presentation of inventories in the context of the historical cost system*. Caulfield, Vic: Australian Accounting Standards Board.

Australian Accounting Standard Board [AASB]. (1996). *Accounting Standard AASB 1022: Accounting for the extractive industries*. Caulfield, Vic: Australian Accounting Standards Board.

Beaver, W. H. (1966). Financial ratios as predictors of failure: Empirical research in accounting. *Selected Studies, supplement to Journal of Accounting Research*, 5, 71-111.

Beaver, W. H. (1968). Market prices, financial ratios, and the prediction of failure. *Journal of Accounting Research*, 6 (2), 179-199.

Betts, J., & Belhoul, D. (1987). The effectiveness of incorporating stability measures in company failure models. *Journal of Business Finance & Accounting*, 14 (3), 323-334.

Booth, P. J. (1983). Decomposition measures and the prediction of financial failure. *Journal of Business Finance & Accounting*, 10 (1), 67-82.

Cairns, D. (1988). Providing the user with a useful statement. *Accountancy,* July, 26-27.

Castagna, A. D., & Matolcsy, Z. P. (1981). The prediction of corporate failure: Testing the Australian experience. *Australian Journal of Management,* 6 (1), 23-50.

Cattell, R. B. (1952). *Factor Analysis: An introduction and Manual for the psychologist and socialist scientist.* New York: Harper & Brothers.

Chen, K. H., & Shimerda, T. A. (1981). An empirical analysis of useful financial ratios. *Financial Management,* 10 (1), 51-60.

Choi, F. D. S. (1997). *International accounting and finance handbook* (2nd ed.). New York: John Wiley & Sons.

Choi, F. D. S., Hino, H., Min, S. K., Nam, S. O., Ujie, J., & Stonehill, A. I. (1983). Analysing foreign financial statements; the use and misuse of international ratio analysis. *Journal of International Business Studies,* Spring/Summer, 113-131.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis.* (2nd. Ed.) Hillsdale, NJ: Erlbaum.

Constable, J. J., & Woodliff, D. R. (1994). Predicting corporate failure using public available information. *Australian Accounting Review,* 4 (1), 13-27.

Courtis, J. K. (1978). Modelling a financial ratios categoric framework. *Journal of Business Finance & Accounting,* 5 (4), 371-386.

Dambolena, I. G., & Khoury, S. J. (1980). Ratio stability and corporate failure. *The Journal of Finance,* 35 (4), 1017-1026.

Everett, J. E., & Entrekin, L. V. (1980). Factor comparability and the advantages of multiple group factor analysis. *Multivariate Behavioral Research,* 2, 165-180.

Ezzamel, M., Brodie, J., & Mar-Molinero, C. (1987). Financial patterns of UK manufacturing companies. *Journal of Business Finance & Accounting,* 14 (4), 519-536.

Hair, J. F. Jr., Anderson, R. E., Tatham, R. L. & Black, W. C. (1995). *Multivariate data analysis with readings* (4th ed.). Prentice Hall, Englewood Cliffs, New Jersey.

Horngren, C. T., Sundem, G. L., & Elliott, J. A. (1993). *Introduction to financial accounting* (5th ed.). Prentice Hall, Englewood Cliffs, New Jersey.

Izan, H. Y. (1984). Corporate distress in Australia. *Journal of Banking and Finance*, 8 (2), 303-320.

Johnson, W. B. (1978). The cross-sectional stability of financial patterns. *Journal of Business Finance & Accounting*, 5 (2), 207-214.

Johnson, W. B. (1979). The cross-sectional stability of financial ratio patterns. *Journal of Financial and Quantitative Analysis*, 14 (5), 1035-1048.

Jones, F. (1987). Current techniques in bankruptcy prediction. *Journal of Accounting Literature*, 6, 131-164.

Jöreskog, K. G., & Sörbom, D. (1996). *PRELIS 2 User's Reference Guide*. Chicago: Scientific Software International.

Jöreskog, K. G., & Sörbom, D. (1999). *LISREL 8.30 and PRELIS 2.30*. Chicago: Scientific Software International.

Laurent, C. R. (1979). Improving the efficiency and effectiveness of financial ratio analysis. *Journal of Business Finance & Accounting*, 6 (3), 401-413.

Lev, B. (1969). Accounting and information theory. *Studies in Accounting Research No. 2*, American Accounting Association.

Lincoln, M. (1984). An empirical study of the usefulness of accounting ratios to describe levels of insolvency risk. *Journal of Banking and Finance*, 8 (2), 321-340.

McNamara, R. P., Cocks, N. J., & Hamilton, D. F. (1988). Predicting private company failure. *Accounting and Finance*, 28 (2), 53-64.

Mensah, Y. M. (1984). An examination of the stationarity of multivariate bankruptcy prediction models: A methodological study. *Journal of Accounting Research*, 22 (1), 380-395.

Mossman, C. E., Bell, G. G., Swartz, L. M., & Turtle, H. (1998). An empirical comparison of bankruptcy models. *The Financial Review*, 33, 35-54.

Norušis, M. J./SPSS Inc. (1994). *SPSS Professional Statistics 6.1*. SPSS Inc.

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.

Pinches, G. E., Eubank, A. A., Mingo, K. A., & Caruthers, J. K. (1975). The hierarchical classification of financial ratios. *Journal of Business Research*, 3 (4), 295-310.

Pinches, G. E., Mingo, K. A., & Caruthers, J. K. (1973). The stability of financial patterns in industrial organizations. *The Journal of Finance*, 28 (2), 389-396.

Platt, H. D., & Platt, M. B. (1990). Development of a class of stable predictive variables: The case of bankruptcy prediction. *Journal of Business Finance & Accounting*, 17 (1), 31-51.

Popoff, B, & Cowan, T. K. (1989). *Analysis and interpretation of financial statements* (3rd ed.). Butterworths Pty Ltd.

Rummel, R. J. (1970). *Applied factor analysis*. Evanston: Northwestern University Press.

Scott, J. (1981). The probability of bankruptcy: A comparison of empirical predictions and theoretical models. *Journal of Banking and Finance*, 5 (3), 317-344.

Shailer, G. P. E. (1990). The multivariate performance of alternative accounting variables for predicting unlisted company failures. *British Accounting Review*, 22, 151-161.

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (2nd ed.). California State University, Northbridge: HarperCollins College Publishers.

Taffler, R. J. (1984). Empirical models for the monitoring of UK corporations. *Journal of Banking and Finance*, 8 (2), 199-227.

Taffler, R. J., & Sudarsanam, P. S. (1979). Auditing the board: A new approach to the measurement of company performance. *Management Finance*, 5 (2), 127-147.

Tatsuoka, M. (1970). Discriminant analysis: The study of group differences. *Selected Topics in Advanced Statistics: An Elementary Approach*, No. 6 (University of Illinois, Institute for Personality and Ability Testing).

Theil, H. (1969). On the use of information theory concepts in the analysis of financial statements. *Management Science*, 15 (9), 459-481.

Walker, M. C., Stow, J. D., & Moriarity, S. (1979). Decomposition analysis of financial statements. *Journal of Business Finance & Accounting*, 6 (2), 173-186.

Weygandt, J. J., Kieso, D. E., & Kimmel, P. D. (1998). *Financial Accounting* (2nd ed.). John Wiley & Sons, Inc.

Zavgren, C. V. (1983). The prediction of corporate failure: The state of the art. *Journal of Accounting Literature*, 2, 1-35.

APPENDIX 1

Sample of firms

Firm name	End of financial period
1.	Abigroup Ltd.	June
2.	Adroyal Ltd.	June
3.	Advent Ltd.	June
4.	Greyhound Pioneer Australia Ltd.	December
5.	Alamain Investments Ltd.	June
6.	Allgas Energy Ltd.	June
7.	Amalgamated Holdings Ltd.	June
8.	Amcor Ltd.	June
9.	Angus & Coote (Holdings) Ltd.	July
10.	ARB Corporation Ltd.	June
11.	Armourglass Ltd.	June
12.	Arrowfield Group Ltd.	June
13.	Atlantic Ltd.	June
14.	Australian Authorised Investments Ltd.	June
15.	Australian Consolidated Investments Ltd.	June
16.	Sausage Software Ltd.	June
17.	Australian Topmaking Services Ltd.	June
18.	Automotive Industrial & Mining Supplies Ltd.	June
19.	F.H. Faulding & Co Ltd.	June
20.	Berklee Ltd.	June
21.	BioDiscovery Ltd.	June
22.	Bisan Ltd.	June
23.	Bridgestone Australia Ltd.	December
24.	Chalmers Ltd.	June
25.	Broken Hill Proprietary Company Ltd.	May
26.	Ipoh Ltd.	December
27.	Burns, Philp & Company Ltd.	June
28.	Formida Holdings Ltd.	June
29.	Residual Assco Group Ltd.	June
30.	Caltex Australia Ltd.	December
31.	Campbell Brothers Ltd.	March
32.	Canberra Investments Corporation Ltd.	June
33.	Cape Range Ltd.	December
34.	Carillon Development Ltd.	June
35.	Carrington Cotton Corporation Ltd.	June
36.	Central Equity Ltd.	June
37.	Centro Properties Ltd.	June
38.	Chapmans Ltd.	December

Firm name		End of financial period
39.	Chieron Holdings Ltd.	June
40.	Citistate Corporation Ltd.	June
41.	Cleland (P.) Enterprises Ltd.	June
42.	Clements Marshall Consolidated Ltd.	September
43.	Coal & Allied Industries Ltd.	June
44.	Coca-Cola Amatil Ltd.	December
45.	Southern Dental Industries Ltd.	June
46.	Comalco Ltd.	December
47.	Computer Power Group Ltd.	September
48.	Continental Venture Capital Ltd.	June
49.	Bliss Corporation Ltd.	June
50.	Country Road Ltd.	July
51.	Coventry Group Ltd.	June
52.	Crane Group Ltd.	June
53.	D.E.M. Ltd.	June
54.	Danks Holdings Ltd.	June
55.	Darowa Corporation Ltd.	June
56.	Bains Harding Ltd.	June
57.	Howard Smith Ltd.	June
58.	Deep Sea Fisheries Ltd.	June
59.	Desane Group Holdings Ltd.	June
60.	Development Capital of Australia Ltd.	June
61.	Ectec Ltd.	December
62.	Eltin Ltd.	June
63.	Embelton Ltd.	June
64.	AUSPINE Ltd.	June
65.	Environmental Group Ltd.	June
66.	Equity Trustees Ltd.	June
67.	Evans Deakin Industries Ltd.	June
68.	FAI Insurance Ltd.	June
69.	FFI Holdings Ltd.	June
70.	Finbar International Ltd.	June
71.	Finemore Holdings Ltd.	June
72.	Fleetwood Corporation Ltd.	June
73.	HydroMet Corporation Ltd.	June
74.	Foster's Brewing Group Ltd.	June
75.	Futuris Corporation Ltd.	June
76.	Gazal Corporation Ltd.	June
77.	Gearhart Australia Ltd.	December
78.	Gemstone Corporation of Australia Ltd.	June
79.	General Publishers Ltd.	June

Firm name		End of financial period
80.	George Weston Foods Ltd.	January
81.	Breakwater Island Trust Ltd.	June
82.	Goodman Fielder Ltd.	June
83.	Gowing Bros. Ltd.	July
84.	Gradipore Ltd.	June
85.	Gunns Ltd.	June
86.	Hancock & Gore Ltd.	September
87.	Harris Scarfe Holdings Ltd.	June
88.	Harvey Norman Holdings Ltd.	June
89.	Helm Corporation Ltd.	June
90.	Henry Walker Group Ltd.	June
91.	Hudson Conway Ltd.	June
92.	Incitec Ltd.	September
93.	Industrial Securities Ltd.	June
94.	International Distillers Holdings Ltd.	June
95.	International Media Management (Holdings) Ltd.	June
96.	James Hardie Industries Ltd.	March
97.	Joe White Maltings Ltd.	June
98.	Joyce Corporation Ltd.	June
99.	Prime Television Ltd.	June
100.	Keith Harris & Co. Ltd.	July
101.	Kimberley Securities Ltd.	June
102.	KLZ Ltd.	February
103.	Koala Corporation Australia Ltd.	June
104.	Leighton Holdings Ltd.	June
105.	Linden & Corway Ltd.	June
106.	Ludowici Ltd.	December
107.	Macarthur National Ltd.	June
108.	Macmahon Holdings Ltd.	June
109.	Macro Corporation Ltd.	June
110.	Markwell Pacific Ltd.	June
111.	Mayne Nickless Ltd.	July
112.	McConnell Dowell Corporation Ltd.	June
113.	McPherson's Ltd.	June
114.	Medical Corporation Australasia Ltd.	June
115.	Medical Innovations Ltd.	June
116.	Rural Press Ltd.	June
117.	Metal Manufacturers Ltd.	December
118.	Mikoh Corporation Ltd.	June
119.	Mirvac Ltd.	June
120.	MRI Holdings Ltd.	June

Firm name	End of financial period
121. Murchison Holdings Ltd.	June
122. National Investments Ltd.	June
123. Newhaven Park Stud Ltd.	June
124. News Corp. Ltd.	June
125. Oldfields Holdings Ltd.	June
126. OPSM Industries Ltd.	June
127. AI Engineering Ltd.	June
128. Orica Ltd.	September
129. Oroton International Ltd.	June
130. Kresta Holding Ltd.	June
131. Pacific Dunlop Ltd.	June
132. AirBoss Ltd.	June
133. Palmer Corporation Ltd.	June
134. Parbury Ltd.	June
135. Payce Consolidated Ltd.	June
136. Peptech Ltd.	September
137. CSR Ltd.	March
138. Pioneer International Ltd.	June
139. CXA Communications Ltd.	June
140. Premier Investments Ltd.	June
141. Prudential Investment Company of Australia Ltd.	June
142. Public Holdings (Australia) Ltd.	December
143. Quantum Resources Ltd.	June
144. Raptis Group Ltd.	June
145. Reece Australia Ltd.	June
146. Rib Loc Group Ltd.	March
147. Ridley Corporation Ltd.	June
148. Rothmans Holdings Ltd.	June
149. Australian Natural Food Holdings Ltd.	June
150. Scantech Ltd.	June
151. Schaffer Corporation Ltd.	June
152. SCITEC Ltd.	June
153. Scott Corporation Ltd.	June
154. Adelaide Brighton Cement Holdings Ltd.	June
155. Select Harvests Ltd.	December
156. Sietel Ltd.	September
157. Solution 6 Holdings Ltd.	June
158. Sonic Healthcare Ltd.	June
159. South East Telecasters Ltd.	June
160. Southcorp Ltd.	June
161. Southern Cross Broadcasting (Australia) Ltd.	June

Firm name	End of financial period
162. Spencer Gulf Telecasters Ltd.	June
163. Coles Myer Ltd.	July
164. Spotless Services Ltd.	June
165. AirCruising Australia Ltd.	June
166. Stockland Trust Group Ltd.	June
167. Structural Systems Ltd.	June
168. Sunbase China Ltd.	June
169. Sunraysia Television Ltd.	June
170. Tag Pacific Ltd.	June
171. Tandou Ltd.	June
172. Tassal Ltd.	February
173. Techniche Ltd.	June
174. Australia Wide Industries Ltd.	June
175. Television & Media Services Ltd.	June
176. Tennyson Holdings Ltd.	June
177. Sumich Group Ltd.	June
178. Tony Barlow Australia Ltd.	June
179. Transmetro Corporation Ltd.	June
180. Korvest Ltd.	June
181. Treloar Group Ltd.	June
182. Triden Corporation Ltd.	June
183. Unitel Corporation Ltd.	June
184. Viking Industries Ltd.	June
185. Villa World Ltd.	June
186. Vision Systems Ltd.	June
187. East African Coffee Plantations Ltd.	May
188. Wadepack Ltd.	December
189. Water Wheel Holdings Ltd.	December
190. Adtrans Group Ltd.	June
191. Watpac Ltd.	June
192. Wattyl Ltd.	June
193. Webster Ltd.	June
194. Wesfarmers Ltd.	June
195. WESFI Ltd.	June
196. Westfield Holdings Ltd.	June
197. Westfield Trust Ltd.	December
198. Westholme Ltd.	June
199. Whittakers Ltd.	June

Factor Matrix (VARIMAX Rotation) for the Pooled Data

Ratio Number	Ratio Name	Return on Investment 1	Short-Term Liquidity I 2	Financial Leverage I 3	Short-Term Liquidity II 4	Financial Leverage II 5	Decomposition Measure 6
13	Earnings Before Interest & Tax to Total Assets	0.934					
12	Earnings Before Interest & Tax to Tangible Total Assets	0.920					
14	Operating Income to Operating Assets	0.867					
3	Cash Flow Before Tax to Current Liabilities	0.831					
16	Funds From Operations to Total Liabilities	0.829					
21	Net Profit After Tax to Shareholders Funds	0.804					
11	Returns on Shareholders Funds	0.799					
10	Earnings Before Interest & Tax to Interest Payments	0.796					
30	Pretax Operating Income to Interest Expense	0.723					
29	Working Capital to Total Assets		0.911				
5	Current Assets to Current Liabilities		0.854				
7	Current Assets to Total Liabilities		0.836				
6	Current Assets to Total Assets		0.787				
1	Quick Ratio		0.684				
25	Shareholders Funds to Total Liabilities			0.873			
27	Total Liabilities to Total Assets			-0.855			
17	Absolute Value of Income Before Tax, Interest & Depreciation to Current Liabilities (exclude Overdrafts)			0.708			
20	Market Value of Equity to Total Liabilities			0.695			
18	Cash to Current Assets				0.770		
23	Quick Liabilities to Current Liabilities				0.712		
22	Quick Assets to Current Assets				0.676		
9	Current Liabilities to Total Liabilities					0.827	
15	Funded Debt (borrowings) to Shareholder Funds					-0.558	
2	Balance Sheet Decomposition Measure						0.681
4	Assets Decomposition Measure						0.610
19	Liabilities Decomposition Measure						0.531

Note. Total Variance Explained = 73.070%.