FACTOR ANALYSIS AND THE SELECTION OF FINANCIAL VARIABLES: SOME UK EVIDENCE

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ABSTRACT

Financial ratios have been used for almost a century now and although there are misgivings about how they perform as an analytical tool, they have generally stood the test of time.

A major problem concerns which ratios should be adopted in order to carry out a multivariate evaluation. The purpose of this paper is to show how factor analysis may be utilised in the selection of ratios for financial evaluation. Additionally the importance of cash flow based ratios is examined in the light of Financial Reporting Standard 1.

The results of the study indicate that factor analysis can be used to reduce the number of variables under consideration for evaluative purposes with minimum loss of explanatory power. Also, cash flow, and in particular Operating Cash Flow, is found to be a significant factor for evaluative purposes, clearly separable from Entity Cash Flow, Funds Flow and liquidity-based factors.

INTRODUCTION

From its origins at the turn of the century, in the form of a single variable — the current ratio — ratio analysis has developed as an important analytical tool in accounting and finance. As Zavgren (1983) argues, current research in the area involves a multi-ratio approach which encompasses a wide range of applications from, for example, the work of Altman (1968) and Deakin (1972) on the prediction of corporate failure, through Meeks' (1977) prediction of merger activity, to Copeland and Ingram's (1982) analysis of bond ratings.

The main weakness in this research is the large number of ratios used in any one study. This can induce problems of interpretation to the extent that particular sets of ratios are highly correlated and measure single attributes of company performance.

Some of these problems can be avoided by the use of factor analysis which, in isolating independent patterns in financial ratios, reduces the number of ratios required without loss of statistical explanatory power. The subset created increases the efficiency of financial analysis, and is also of value to researchers concerned with determining the nature of relationships between the financial states of a company and some possible outcome, such as corporate failure.

The present paper applies factor analysis in its principal components form to companies in the UK drawn from the two largest industrial sectors: General Engineering and the Miscellaneous classification. The results show that factor analysis may be utilised as a data reduction device, with common factors being frequently discovered for the two samples, the most interesting being the Operating Cash Flow factor. Those factors determined, however, were generally not stable on a cross-industry or sample basis from year to year.

The remainder of the paper is presented in the following form. A brief analysis of some of the previous literature is presented. This is followed by an outline of factor analysis. The sample characteristics of the present study and the scope of the ratios used are then discussed before presentation of the empirical results and the conclusions.

PREVIOUS EMPIRICAL RESEARCH

Laurent (1979) suggests that financial analysis would be considerably enhanced if redundancy was removed by identifying a small critical set of independent financial ratios or measures which contain most, if not all, of the information in a complete set of financial ratios. Such a subset, in addition to making general financial analysis more efficient, would also be of value to researchers wishing to determine the nature of relationships between the financial status of a company and some possible outcome, for example, the prediction of corporate failure. Operationalising financial ratios would enable the researcher to justify the use of the chosen ratios for their completeness of coverage of the financial profile of a firm and independence.

Faced with a bewildering array of potentially useful financial ratios, the user is often forced to rely upon some system for reducing the array to a manageable number of ratios. Typically, the user may classify ratios into groups, and choose one ratio from each group, in the hope that the small subset of financial ratios will adequately describe the characteristics of the firms under study (Gombola and Ketz 1983). Barnes (1982) notes, however, that identifying those ratios which contain complete information about a firm while minimising duplication cannot be achieved purely by logic. An understanding of the empirical relationships among ratios is a prerequisite to developing some system for classifying financial ratios. If one lacks this understanding, then the grouping of financial ratios will be *ad hoc*. Added to this, different users may employ vastly different subsets of financial ratios even when used for the same purpose. When different financial ratios are employed in different studies, comparison of results is made unduly complex.

Employing data reduction techniques, some researchers have collapsed large sets of ratios into a much smaller number of underlying financial structures (patterns or factors) which retain most of the information contained in the original data. (See, for example, Pinches et al., 1973; Johnson, 1978; Laurent, 1979; Taffler and Sudarsanam, 1979; Ezzamel et al., 1987; and Clarke, 1990).

Ezzamel et al. (1987) notes that there are some noticeable disparities in the results reported in the studies alluded to above. Specifically, 50% of the factors identified are unique to one study or another. This disparity may in part be attributed to differences in sample sizes, numbers and types of ratios used, limits imposed on the number of factors extracted, periods of study and finally country of study. Such disparity offers little comfort to researchers who wish to make use of these results as a guide for choosing a small number of 'representative' ratios.

Gombola and Ketz (1983) found some perplexing problems with the factor analyses as performed by Pinches, Mingo and Caruthers (1973). Relationships among those variables closely associated with the return on investment factors were the main cause for their concern. Profitability ratios such as net income/assets and net income/net worth are closely associated with the return on investment factor, but so were ratios such as cash flow/assets and cash flow/net worth. Such results, they argued, would indicate that profitability measures and cash flow measures capture the same characteristic or facet of firm performance. This idea would run counter to the idea that accounting profitability measures indicate operating performance whereas cash flow measures signify solvency and financial flexibility.

The definition of cash flow ratios employed in previous studies may have been responsible for the observed relationship between profitability ratios and cash flow ratios. Specifically Pinches et al. (1973) define cash flow as the sum of net income plus depreciation. The proper measure of cash flow, Gombola and Ketz (1983) maintain, should be cash receipts from operations less cash disbursements for operations, and this differs markedly from the simple proxy employed by Pinches et al. (1973).

The primary objective of this study is to investigate whether the factors obtained from employing data reduction techniques on financial ratios are inter-temporally stable and homogeneous across industry classifications. A secondary objective is to investigate whether the use of a more sophisticated definition of cash flow clarifies which aspect of firm performance is captured by ratios based upon cash flow variables.

FACTOR ANALYSIS

Factor analysis is a multivariate statistical tool that allows one to reduce the variable space under consideration to a smaller number of factors. The factor patterns, as indicated by the variance, Johnson (1978) emphasises, have the property of retaining the maximum amount of information contained in the original data. This, as Burt (1940) contends, leads to the 'orderly simplification' of a number of interrelated measures. When a group of variables has, for some reason, a great deal in common, a factor may be said to exist (Child, 1991).

The aim of the method of principal components factor analysis is the construction out of a set of variables, X_js ($j = 1,2,...,k$) a set of new variables (F_is) called principal component factors, which are linear combinations of the X's; as shown below:

$$F_1 = a_{11} X_1 + a_{12} X_2 + ... + a_1 K_X K$$
$$F_2 = a_{21} X_1 + a_{22} X_2 + ... + a_2 K_X K$$
$$\vdots$$
$$F_N = a_{K1} X_1 + a_{K2} X_{K2} + ... + a_K K_X K$$

The first factor accounts for the maximum proportion of the total variance of all X's. The same with the second, allowing for the variation accounted for by the first factor and so on. The factor loadings are represented by the a's.

Simply put, the technique allows one to provide a parsimonious description of observed data and thus to determine, from the total set of ratios analysed, a smaller set of independent factors which account for most of the variance, and therefore most of the information, contained in the original set.

The principal components factor analysis technique uses an orthogonal rotation of the initial factor pattern and therefore produces rotated factors which, as Clarke (1990) indicates, are linearly independent and orthogonal. Subsequent rotation of this factor pattern provides a clearer resolution of the underlying factors.

In theory there may be as many factors as there are original variables. Being consistent, however, with the purpose of factor analysis, one will want to employ only those factors that contribute substantially to explaining variation in the original data set, with other factors being discarded. Kim and Mueller (1978) state: '... a major step in factor analysis is to find the number of factors that can adequately explain the observed correlations (or covariances) among the observed variables'. Child (1991) specifies two methods which may be used to achieve this: the Kaiser's criterion and the scree test. On the basis of support provided by Child (1991) and Gorsuch (1983), the scree test was adopted.

Most analysts agree that some solutions provided by straightforward factor analysis are not sufficient. In most cases adjustment to the frames of reference improves the interpretation by reducing some of the ambiguities which often accompany the preliminary analysis. As Kim and Mueller (1978) indicate, in order to obtain the initial solution, certain restrictions are typically imposed. These restrictions are: (i) there are k common factors; (ii) underlying factors are orthogonal to each other; and (iii) the first factor accounts for as much variance as possible, the second factor accounts for as much of the residual variance left unexplained by the first factor, and so on.

The first restriction remains in effect throughout a given analysis. The second and third restrictions are considered arbitrary, and one or both are removed in the rotation stage in order to obtain simpler and more readily interpretable results. Rotation is the process of manipulating the reference axes, with two general forms available, orthogonal and oblique. Kim and Mueller (1978) advise the user not to be unduly concerned about the choice of rotation method, recommending the Varimax rotation where orthogonal rotation is sought, or Direct Oblimin if oblique rotation is required. As one wishes to have independent factors which might be of use in mathematical models, the widely used Varimax rotation is adopted.

SAMPLE CHARACTERISTICS AND SCOPE OF RATIOS

The sample used in this study was selected from Datastream. It covers the period 1963-93. The two largest industrial classifications in the UK were chosen since this gave a sufficient size to the sample in terms of number of companies. The classifications were Engineering General (122 companies, 1992), and Miscellaneous industries (111 companies, 1992). Data on these industries was down-loaded for the years 1986, 1988, and 1990, the only periods without missing observations. With the selection of the Miscellaneous classification, comprising of various companies not attributable specifically to any sector, it was hoped that the factors extracted and representative ratios might be of use in general analysis across various industrial sectors.

The ratios utilised were drawn from other papers in the area, for example, Pinches et al. (1973) and Ezzamel et al. (1987). The rationale for the use of these ratios being to determine if the factors and, consequently the ratios representing those factors, derived by this study were similar to those discovered by the other research in the area. If this was so, then further support would be achieved for the general use of these common factors and representative ratios. From these papers 175 ratios were derived, less duplications.

After down-loading these from Datastream for the industries concerned, and eliminating firms and ratios where there was incomplete data, 140 ratios remained, with the largest sample size being 92 companies (Engineering General 1990), and the smallest 38 companies (Miscellaneous 1986) (**Table 1**). On the basis that one must have at least as many observations as variables, 59 ratios were drawn randomly for further analysis (**Appendix 1**), and the smallest sample of 38 companies (Miscellaneous 1986) was dropped from the study. This figure is slightly more than the 53 utilised by Ezzamel et al. (1987), the largest UK study to date.

EMPIRICAL RESULTS

Factor analysis on both industrial classifications (Engineering General and Miscellaneous) resulted in the extraction of seven factors in all three years of the analysis. For the Engineering General classification, these

Table 1: Industries analysed & sample size

Industry	Year	Sample size
Engineering General	1986	72
Engineering General	1988	92
Engineering General	1990	92
Miscellaneous	1986	38*
Miscellaneous	1988	69
Miscellaneous	1990	91

* Sample size below minimum required.

seven factors represented a high proportion of the total variance (information) contained in the original data matrix: 75.6% in 1986, 80.6% in 1988, and 67.3% in 1990 (**Table 2**). The same was true of the Miscellaneous classification, with 67.3% in 1988, and 71.8% in 1990 (**Table 3**). Only ratios with loadings greater than 0.40 were considered to be significant.

For Engineering General (**Table 2**), the seven factors in 1986 were as follows: Earnings, Operating Cash Flow, Long Term Debt, Funds Flow, Income, Total Capital, and Total Debt. Generally, with the exception of factors representing Net Worth and Total Assets which appeared in 1988 and 1990, similar factors were obtained in the other two years of the analysis. No concise conclusion could, however, be drawn about the stability of the ratios representing these factors with, for example, the ratio of LTD/NW representing the Long Term Debt Factor in all three years of the analysis, but with the likes of Operating Cash Flow being represented by OCF/TA in 1988 and 1990, and by OCF/TC in 1986. The same mixed results permeated throughout the analysis.

With the Miscellaneous classification (**Table 3**) similar factors were extracted in comparison with the Engineering General classification for each of the two years. The factors for 1988 were as follows: Operating Cash Flow, Long Term Debt, Income 1, Funds Flow, Income 2, Total Debt, and Equity.

One interesting finding in both industrial classifications was the percentage of the variance represented by the Operating Cash Flow factor. This factor always appeared as one of the top four factors in each year of the analysis, and in the year in which it was the fourth factor, Engineering

Table 2. Factors, ratios, loading, & percentage of variance explained for Engineering General — 1986/1988

Factor Year: 1986	**Ratio**	**Loading**	**% of variance explained**
Earnings	EBIT/TL	0.97819	27.7%
Operating Cash Flow	OCF/TCE	0.93747	12.7%
Long-Term Debt	LTD/NW	0.98840	10.4%
Funds Flow	FF/TCE	0.95751	9.4%
Income	NI/Equity	0.78423	6.8%
Total Capital	NI/TCE	0.91704	4.9%
Total Debt	FA/TD	0.86032	3.9%
Total % of variance explained			**75.6%**

Factor Year: 1988	**Ratio**	**Loading**	**% of variance explained**
Total Assets	NI/TA	0.94495	22.9%
Operating Cash Flow	OCF/TA	0.94276	14.5%
Long-Term Debt	LTD/NW	0.97387	12.4%
Fixed Assets	FA/TA	0.96004	10.2%
Funds Flow	FF/NW	0.96360	8.0%
Income	NW/S	0.75081	7.0%
Net Worth	NW/TA	0.85256	5.6%
Total % of variance explained			**80.6%**

General 1990, these four factors represented 54.5% of the information in the original data matrix (**Table 2**). In the years in which it was the first factor to be extracted, 1990 for Engineering General (**Table 2**), and

Table 2 Continued: Factors, ratios, loading & percentage of variance explained for Engineering General : 1990

Factor Year: 1990	Ratio	Loading	% of variance explained
Operating Cash Flow	OCF/TA	0.95009	18.3%
Long-Term Debt	LTD/NW	0.96469	14.0%
Income 1	NI/SH_FDS	0.89464	10.3%
Funds Flow	FF/TCE	0.95746	8.9%
Income 2	NI/REV	0.92070	6.5%
Net Worth	NW/TA	0.81631	5.2%
Total Debt	NI/TD	0.82872	4.1%
Total % of variance explained			**67.3%**

1988 for Miscellaneous (**Table 3**), the single factor of Operating Cash Flow accounted for 18.3% and 18% respectively of the information in the original data matrix.

The Entity Cash Flow ratios incorporated in the analysis did not appear as a significant factor. Therefore, it is quite clear that the Operating Cash Flow factor is a significant factor independent of either liquidity-based ratios, or the Entity Cash Flow ratios incorporated into the analysis. No previous study in the area has ever been able to distinguish so clearly a cash flow factor independent of liquidity-based ratios and, more importantly, differentiate between two closely related definitions of cash flow. This would seem to support Gombola & Ketz (1983) and their assertion concerning the importance of definition with regards to cash flow.

CONCLUSION

The results generally show that factor analysis may be utilised as a data reduction device to assist the user of financial statements in determining

Table 3: Factors, ratios, loading, & percentage of variance explained for Miscellaneous 1988/1990

Factor Year: 1988	Ratio	Loading	% of variance explained
Operating Cash Flow	OCF/TL	0.91042	18.0%
Long-Term Debt	LTD/TCE	0.95805	12.1%
Income 1	NI/TCE	0.92855	10.3%
Funds Flow	FF/TCE	0.96362	8.4%
Income 2	NI/REV	0.91675	7.4%
Total Debt	FA/TD	0.85880	6.1%
Equity	NI/EQTY	0.78477	5.0%
Total % of variance explained			**67.3%**

Factor Year: 1990	Ratio	Loading	% of variance explained
Income 1	NI/TA	0.96488	20.1%
Long-Term Debt	LTD/NW	0.97301	15.3%
Funds Flow	FF/NW	0.91673	10.8%
Operating Cash Flow	OCF/TL	0.88882	8.3%
Total Debt	NI+DEP/TD	0.97171	7.3%
Working Capital	NI/WC	0.78956	5.4%
Net Worth	NW/S	0.71045	4.6%
Total % of variance explained			**71.8%**

what ratios might be of use when one wishes to interpret financial statements. However, although in this analysis the same factors frequently were discovered for the two industrial classifications analysed, the ratios representing these factors often did not hold from year to year, indicating an instability in these ratios to represent those factors over any significant period of time. The most interesting result is probably that of the Operating Cash Flow measure which appeared to represent a different measure of performance, particularly with regards to the liquidity ratios and entity cash flow ratios utilised within the study.

How do these results compare with previous studies? In this study 67.3% to 80.6% of the total variance was explained by the factors extracted, compared to 83% Clarke (1990), 86% in Johnson (1978), and 93% in Taffler & Sudarsanam (1979). Of the factors extracted in this study, one has previously been identified by all studies reviewed, namely Long Term Debt (Financial Leverage). Net Worth (Capital Intensiveness) shows similarities to some UK results, in particular Taffler & Sudarsanam (1979), while the Fixed Asset factor closely matches Laurent's (1979) factor of Fixed Asset Management for his Hong Kong study.

Differences in results may be due to deviations in sample sizes, years of study, original ratios utilised, definition of ratios used, or country of study. This, along with the significance of the Operating Cash Flow factor, may, therefore, provide further research possibilities to determine how significant these and other elements are to the overall results.

APPENDIX 1
RATIOS UTILISED

(1) **EBIT/TOTAL LIABILITIES –** (153+154)/(385+318+319)
(2) **EBIT/FIXED CHARGES** – (154+153)/(153+166+167)
(3) **FIXED ASSETS/NET WORTH** – 339/391
(4) **FIXED ASSETS/TOTAL ASSETS** – 339/(391+389)
(5) **FIXED ASSETS/TOTAL DEBT** – 339/(318+319)
(6) **FIXED CHARGES/EBIT** – (153+166+167)/(153+154)
(7) **FUNDS FLOW/SALES** – (104-129+136)/104
(8) **FUNDS FLOW/TOTAL CAPITAL EMPLOYED** – (104-129+136)/322
(9) **FUNDS FLOW/TOTAL ASSETS** – (104-129+136)/(391+389)
(10) **FUNDS FLOW/NET WORTH** – (104-129+136)/(391)
(11) **LONG TERM DEBT/TOTAL CAPITAL** – 219/307
(12) **LONG TERM DEBT/NET PLANT** – 319/(328-336)
(13) **LONG TERM DEBT/NET WORTH** – 319/391
(14) **LONG TERM DEBT/SHAREHOLDERS' FUNDS** – 319/307
(15) **LONG TERM DEBT/TOTAL ASSETS** – 319/(391+389)

(16) **LONG TERM DEBT/TOTAL DEBT** – 319/(318+319)
(17) **NET INCOME PLUS DEP/TOTAL ASSETS** – (157+136)/(391+389)
(18) **NET INCOME PLUS DEP/EQUITY** – (157+136)/(301+306)
(19) **NET INCOME PLUS DEP/SALES** – (157+136)/104
(20) **NET INCOME PLUS DEP/TOTAL DEBT** – (157+136)/(318+319)
(21) **NET INCOME/NET WORTH** – 157/391
(22) **NET INCOME/EQUITY** – 157/(301+306)
(23) **NET INCOME/REVENUE** – 157/(104+105+106)
(24) **SALES/TOTAL ASSETS** – 104/(391+389)
(25) **NET INCOME/SALES** – 157/104
(26) **NET INCOME/SHAREHOLDERS' FUNDS** – 157/307
(27) **NET INCOME/TOTAL ASSETS** – 157/(391+389)
(28) **NET INCOME/TOTAL CAPITAL** – 157/(307+321)
(29) **NET INCOME/TOTAL DEBT** – 157/(318+319)
(30) **NET INCOME/TOTAL LIABILITIES** – 157/(385+318+319)
(31) **NET INCOME/WORKING CAPITAL** – 157/390
(32) **NET PLANT/NET WORTH** – (328-336)/391
(33) **NET QUICK ASSETS/FUNDS EXPENDITURES** – (390+389-364)/460
(34) **NET WORTH/SALES** – 391/104
(35) **NET WORTH/TOTAL ASSETS** – 391/(389+391)
(36) **SALES/TOTAL INCOME** – 104/141
(37) **OPERATING CASH FLOW/CURRENT LIABILITIES** – ((135+153+417)-(445+448))/389
(38) **OPERATING CASH FLOW/TOTAL CAPITAL EMPLOYED** – ((135+153+417)-(445+448))/322
(39) **OPERATING CASH FLOW/TOTAL LIABILITIES** – ((135+153+417)-(445+448))/(385+318+319)
(40) **OPERATING CASH FLOW/EQUITY** – ((135+153+417)-(445+448))/(385+318+319)
(41) **OPERATING CASH FLOW/NET WORTH** – ((135+153+417)-(445+448))/391
(42) **OPERATING CASH FLOW/SALES** – ((135+153+417)-(445+448))/104
(43) **OPERATING CASH FLOW/SHAREHOLDERS' FUNDS** – ((135+153+417)-(445+448))/307
(44) **OPERATING CASH FLOW/TOTAL CAPITAL** – ((135+153+417)-(445+448))/(307+321)
(45) **OPERATING CASH FLOW/TOTAL ASSETS** –

((135+153+417)-(445+448)/(391+389)

(46) **EBIT/TOTAL ASSETS** – (154+153)/391

(47) **TOTAL LIABILITIES/TOTAL NET WORTH** – (385+318+319)/391+176)

(48) **ENTITY CASH FLOW/CURRENT LIABILITIES** – ((135+153+417)-(445+448+435+436+423+457+433))/389

(49) **ENTITY CASH FLOW/TOTAL CAPITAL EMPLOYED** – ((135+153+417)-(445+448+435+436+423+457+433))/322

(50) **ENTITY CASH FLOW/TOTAL LIABILITIES** – ((135+153+417)-(445+448+435+436+423+457+433))/(385+318+319)

(51) **ENTITY CASH FLOW/EQUITY** – ((135+153+417)-(445+448+435+436+423+457+433))/(301+302)

(52) **ENTITY CASH FLOW/TOTAL CAPITAL** – ((135+153+417)-(445+448+435+436+423+457+433))/(307+321)

(53) **ENTITY CASH FLOW/TOTAL DEBT** – ((135+153+417)-(445+448+435+436+423+457+433))/(318+319)

(54) **ENTITY CASH FLOW/WORKING CAPITAL** – ((135+153+417)-(445+448+435+436+423+457+433))/390

(55) **ENTITY CASH FLOW/TOTAL ASSETS** – ((135+153+417)-(445+448+435+436+423+457+433))/(391+389)

(56) **CURRENT ASSETS/SALES** – (380+389)/104

(57) **QUICK ASSETS/CURRENT LIABILITIES** – ((390-364)+389)/389

(58) **WORKING CAPITAL/TOTAL CAPITAL EMPLOYED** – 390/(307+321)

REFERENCES

Altman, E. (1968). "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", *Journal of Finance,* September, pp. 589-609.

Barnes, P. (1982). "Methodological Implications of Non-Normally Distributed Financial Ratios", *Journal of Business Finance & Accounting,* Spring 1982, pp. 51-62.

Burt, C. (1940). *The Factors of the Mind,* University of London Press.

Child, D. (1991). *The Essentials of Factor Analysis,* Cassell.

Clarke, P. (1990). "An Empirical Analysis of Useful Financial Ratios:

An Explanatory Study of Irish Public Quoted Companies", *IBAR Vol. 11,* pp. 40-52.
Copeland, G. & Ingram, J. (1982). "The Association Between Municipal Accounting Information and Bond Rating Changes", *Journal of Accounting Research,* Autumn, pp. 275-289.
Deakin, E. (1972). "A Discriminant Analysis of Predictors of Business Failure", *Journal of Accounting Research,* Spring, pp. 167-179.
Ezzamel, M., Brodie, J. & Mar-Molinero, C. (1987). "Long Term Stability of Financial Patterns in UK Manufacturing Companies", *Journal of Business Finance & Accounting,* Winter, pp. 519-536.
Gombola, M. & Ketz, J. (1983). "A Note on Cash Flow and Classification Patterns of Financial Ratios", *The Accounting Review,* January, pp. 105-114.
Gorsuch, R. (1983). *Factor Analysis,* Second Edition, Lawrence Erlbaum Associates.
Johnson, W. (1978). "The Cross Sectional Stability of Financial Patterns", *Journal of Business Finance and Accounting,* Summer, pp. 207-214.
Kim, J. & Mueller, C. (1978). "Introduction to Factor Analysis: What It Is and How To Do It", *Sage University Paper Series on Quantitative Applications in the Social Sciences,* 07-013, Sage Publications.
Meeks, G. (1977). *Disappointing Marriage, A Study of the Gains from Merger,* Cambridge University Press.
Laurent, C. (1979). "Improving the Efficiency and Effectiveness of Financial Ratio Analysis", *Journal of Business Finance and Accounting,* Autumn, pp. 401-413.
Pinches, G., Mingo, A. & Caruthers, J. (1973). "The Stability of Financial Patterns in Industry Organisations", *Journal of Finance,* May, pp. 389-396.
Taffler, R. and Sudarsanam, P. (1979). "Auditing the Board, a New Approach to the Measurement of Company Performance", *Managerial Finance*, pp. 127-147.
Zavgren, C.V. (1983). "The Prediction of Corporate Failure: The State of the Art", *Journal of Accounting Literature,* Vol. 2, pp. 1-35.