ANALYSING FINANCIAL STATEMENTS: HOW MANY VARIABLES SHOULD WE LOOK AT?

by

Stephen L. Taylor

Department of Accounting, The University of Sydney

Introduction

This paper reports the results of some recent research which may be of interest to those engaged in the analysis of financial statements. These results suggest that, for a broad sample of companies, most of the annual variation in a comprehensive set of numbers typically derived from financial statements can be captured by a few leading indicators. Support is provided for the proposition that, for the most part, financial analysts could adopt a more cost-effective approach by concentrating on a few key variables, unless, of course, circumstances demand an extremely detailed investigation.

The following section of the paper describes the approach adopted to test for the existence of leading indicators. The final section of the paper provides a discussion of the results, and their implications for those involved in the analysis of external financial reports.

The Structure of Financial Statement Data

Analysts who examine corporate financial statements are concerned with maximizing the amount of information they can extract within a given amount of time. An analyst examining a large number of financial measures and ratios calculated from a single set of financial statements will probably consider numbers which, in some cases, are quite highly correlated with each other. After all, they have all been derived from the same annual report!

If it is the annual variation in the data which is of most interest to analysts, a question which might be asked is: Can the annual variation in many of the numbers contained in accounting reports be captured by a much smaller sub-set of that data? A positive response to this question suggests that it may be possible to reduce the number of ratios examined by financial analysts, without any significant loss of information.

The successful construction of failure and takeover prediction models indicates that models which contain a limited number of appropriately weighted variables are useful for predicting specific events of interest[1]. However, unlike models of say, failure prediction, the research described in this paper is concerned with the general variation in accounting numbers from year to year, and the extent to which this variation can be successfully captured by the use of leading indicators.

Seventeen variables were selected as being representative of accounting data which in both the academic and applied literature, are claimed to be "useful". While the list is not exhaustive, it nonetheless provides a wide range of data relating to performance, capital structure, liquidity, and growth. Three measures of performance are used, namely net income, operating income, and cash flow. This reflects the fact that analysts often adjust net profit for the effects of extraordinary items and non-cash accruals respectively. Each of these variables were also included in book rate-of-return form, as well as being used to calculate a debt-coverage ratio. The use of debt coverage rather than interest coverage was made necessary by the non-disclosure of interest expense by many companies in the earlier years of the study. However, for a sample of firms, the correlation between changes in interest coverage and the variable used here was extremely high, so that debt and interest coverage basically convey the same information. Table 1 provides a full list of the variables.

Each of the variables described in Table 1 was calculated using data from the Australian Graduate School of Management's Annual Report File. So as to conduct an adequate search for the existence of any leading indicators, it was necessary to have a large number of observations for each variable across a large number of time periods. This was achieved by taking the relevant data from all June 30 year-end companies

TABLE 1

Accounting Variables Selected for Analysis

Description	Notation Used
A. Performance Variables	
(i) Net Income	NETINC
Net Income/Total Assets	NITOTASS
Net Income/Total Debt	NITOTDEB
(ii) Operating Income	OPINCOME
Operating Income/Total Assets	OITOTASS
Operating Income/Total Debt	OITOTDEB
(iii) Cash Flow	CASHFLOW
Cash Flow/Total Assets	CFTOTASS
Cash Flow/Total Debt	CFTOTDEB
B. Leverage Variables	
Debt/Equity	DEBTEQ
Current Liabilities/Total Assets	CLTOTASS
Long Term Liabilities/Total Assets	LTLIABTA
C. Liquidity Variables	
Current Assets/Current Liabilities	CACL
Quick Assets/Current Liabilities	QACL
Working Capital/Total Assets	WCTOTASS
D. Growth	
Dividend	DIVIDEND
Total Assets	TOTASS

on the file at June 30, 1957, which had complete data up to the most recently recorded year end, 1982, at the time of the research. This sample comprised 96 companies, and for these, the annual charge in each of the 17 variables was calculated over 25 years. Hence, some 2,400 annual observations were obtained for each variable, pooled across companies and across time. In this way, the underlying question of whether a few leading indicators exist could be addressed, irrespective of firm or time.

In analysing the data, a technique known as principal component analysis was applied[2]. This is a statistical procedure, whereby a weighted set of the seventeen numbers is formed such that it explains more of the variation in the numbers than any other weighted set. These weights are called score-coefficients, and the combined set of seventeen weighted numbers is called a principal component. Subsequent (the second, third, etc) principal components are formed in a similar way, but with the proviso that there is no correlation between any of the principal components. Each principal component has an "eigenvalue", which is a (relative) measure of the significance of the associated principal component. Table 2 contains the results of this analysis for the first five principal components.

TABLE 2

Composition of Principal Components

	PC1	PC2	PC3	PC4	PC5
CFTOTASS	0.03914	0.22800	-0.03993	0.38476	0.75731
CFTOTDEB	0.05022	-0.00544	-0.00666	0.00925	0.02028
CASHFLOW	-0.01079	0.45296	0.00516	-0.01493	-0.02258
NITOTASS	-0.06893	-0.27234	0.04493	0.73801	-0.86368
NITOTDEB	0.69869	-0.18778	-0.04244	0.08719	0.70928
NETINC	-0.00835	0.43045	-0.01479	0.00250	-0.04366
OITOTASS	0.00522	0.04189	-0.01704	-0.01627	-0.11391
OITOTDEB	0.28359	0.17351	-0.08081	-0.12093	-0.71594
OPINCOME	-0.99164	0.10808	-0.00133	-0.00472	-0.05331
DEBTEQ	-0.00847	-0.08608	-0.00346	0.30393	0.36461
CLTOTASS	0.00141	0.00039	-0.00763	-0.00081	0.03749
LTLIABTA	0.00046	0.00782	-0.00126	-0.00862	0.00533
CACL	-0.08860	0.01822	0.67276	-0.00488	-0.00906
QACL	-0.05588	-0.01448	0.34816	0.01394	0.01284
WCTOTASS	-0.00133	0.00262	0.00212	0.00291	-0.00449
DIVIDEND	-0.00209	0.03439	0.01842	0.00472	0.18681
TOTASS	-0.00104	0.02037	0.00377	-0.00959	0.00146

To interpret these results, one first looks for the most heavily weighted variable within the first (ie the most significant) principal component. An inspection of Table 2 indicates that, for principal component one (P.C.1), the most heavily weighted variable is net income/total debt (NITOTDEB). For the second principal component (P.C.2), both cash flow and net income are more heavily weighted than the other variables. However, as both these variables are highly correlated[3], the message conveyed by P.C.2 is that annual changes in undeflated performance measures are significant. As cash flow is weighted slightly more heavily, it is best chosen as representative of P.C.2.

In a similar fashion, the third principal component (P.C.3) is based most heavily on measures of liquidity, with the most important being the change in the current ratio (CACL). The fourth principal component (P.C.4), when analyzed in this manner, appears to represent changes in the return on total assets, the most heavily weighted of which is the accounting rate of return (NITOTASS). Finally, the fifth principal component is perhaps representative of those referred to by Dhrymes (1970); they are largely statistical artifacts, and hence are difficult, if not impossible, to interpret.

Table 3 describes the relative importance of each of the first five principal components. Between them, some 65 per cent of all variations in the set of 17 annual ratios and indicators is explained. For the remainder, no other principal component (eg P.C.6, 7, etc) explains more than 5 per cent of the total variation.

TABLE 3
Relative Importance of Principal Components

Principal Component	Eigenvalue	Pct. of Var.	Cum Pct.
1	3.2731	19.3	19.3
2	2.7078	15.9	35.2
3	2.1492	12.6	47.8
4	1.6545	9.7	57.6
5	1.2312	7.2	64.8

Discussion

The results described in Tables 2 and 3 suggest that a major proportion of the annual variation in popularly cited accounting numbers and ratios can be explained by a few, selected leading indicators. The four most significant principal components are clearly representative of commonly used accounting-based measures. Most significantly, three of the first four key indicators suggested by the principal component analysis are periodic performance measures, namely debt coverage, cash flow, and accounting rate-of-return. These results are, on reflection quite reassuring. One would expect much of the change that occurs in the structure of the balance sheet to be reflected in changes in periodic performance. The results described in Table 2 confirm this.

It is also worth noting that, while the preferred undeflated measure is cash flow (P.C.2), for deflated measures, (P.C.1 and P.C.4), accrual accounting concepts are apparently more suitable. This confirms the expectation that accrual accounting measures should be more relevant as numerators for debt (interest) coverage and rate-of-return ratios than cash flow. However, proponents of cash flow measures of performance can gain some comfort from the apparent superiority of cash flow vis a vis net or operating income. Interestingly, those indicators using operating income either by itself or as a numerator do not appear to be of any significance in explaining the variation in the full set of seventeen variables. This result casts some doubt on the value of making adjustments to eliminate the effect of extraordinary items.

Of interest is the insignificant role of measures of capital structure change, dividend change, and growth in assets. Apart from the three selected performance indicators, the only other measure of any significance is the current ratio (ie changes in liquidity). It is evident that most of the annual variation in financial indicators derived from annual accounting reports is influenced by variations in the firms cash flow, rate-of-return and debt (interest) coverage, along with changes in short-term liquidity.

The effects of changes in capital structure, growth rates, and dividends are presumably reflected in the four above-mentioned variables. While this result may appear intuitive, it is nonetheless important to confirm such intuition. Hence, the results in this paper support the belief held by some that analysis of financial statements is probably best accomplished by seeking detailed explanations for changes in a few leading indicators, rather than simply "number-crunching" a large variety of figures without gaining an adequate understanding of what is really going on behind those numbers.

FOOTNOTES

1. An overview of much of this work is provided by Ohlson (1980).
2. The use of principal component analysis is discussed in detail by Dhrymes (1970). For a detailed discussion of the application of this technique to the database described in this paper, see Taylor (1985).
3. Taylor (1985), provides evidence of the high correlation between some of these variables.

REFERENCES

Dhrymes, P., *Econometrics: Statistical Foundations and Applications,* (Harper and Row, 1970).

Ohlson, J.A., "Financial Ratios and the Probabilistic Prediction of Failure", *Journal of Accounting Research,* (Spring, 1980), pp 109-131

Taylor, S.L., "Principal Component Analysis: An Application to the Information Content Testing Issue", Conference Proceedings, Accounting Association of Australia and New Zealand (August, 1985).