The Hierarchical Classification of Financial Ratios

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The predictive value of financial ratios and related financial data has received considerable attention in recent years. Primary areas of investigation have included analysis of the characteristics of merged firms [32,35], prediction of corporate bond ratings [17,27,29,40], and anticipation of financial impairment [1,2,7,24,36,37,38,42]. Related studies have been concerned with identifying the differences in financial ratio averages among industries [13,14], determining whether firms seek to adjust their financial ratios toward industry averages [23], specifying the empirical basis of financial ratios [16], and analyzing the relationships between accounting-determined and market-determined risk measures [3,12,30]. A primary conclusion to be drawn from these studies is that specific financial ratios can be useful for predictive purposes.

While previous studies have shown that a number of individual financial ratios have predictive value when properly employed, it is difficult to generalize the results due to a lack of understanding of the empirical similarities among financial ratios. The degree of empirical similarity among the various financial ratios employed in empirical testing, discussed in the literature, and presented in textbooks is not fully known.[1] Horrigan, after finding that certain financial ratios were highly intercorrelated, stated: "This presence of collinearity is both a blessing and a curse for financial ratio analysis. It means that only a small number of financial ratios are needed to capture most of the information ratios can provide, but it also means that this small number must be selected very carefully" [16:561].

In another study, Pinches, Mingo, and Caruthers employed factor analysis in examining the interrelationships among financial ratios

and in determining the long-term stability of empirically based financial ratio groups over the 1951-69 time period. They concluded: "The results indicate that meaningful empirically-based classifications of financial ratios can be determined and that the composition of these groups are reasonably stable over time, even when the magnitude of the financial ratios are undergoing change" [28:395].

The purposes of this study are: to examine the short-term stability of empirically based financial ratio groups over the 1966-69 time period, as opposed to the long-term relationships examined previously [28]; to determine the hierarchical relationships among these empirically based financial ratio groups; and to integrate the recent empirical findings on the predictive significance of individual financial ratios with the empirically based similarities identified in this study. By providing a greater understanding of these empirical relationships, the present study provides a further basis for the formulation of testable hypotheses of the predictive value of financial statement data.

Method

The financial data employed in the study were obtained from the COMPUSTAT data tapes. The data were screened to exclude firms with missing observations in 1966, 1967, 1968, or 1969 for the following data items: cash, receivables, inventory, current assets, current liabilities, total assets/liabilities, net plant, net sales, operating income, depreciation and amortization, net income, total invested capital, cost of goods sold, long-term debt, fixed charges, income taxes, and nonrecurring income/expenses.[2] Two hundred twenty-one industrial firms having the required financial data were included in the study. The 48 financial ratios examined are listed in Table 1. These particular ratios were selected after a thorough review of prior studies involving financial ratios. No ratios involving preferred stock were included due to an insufficient number of industrial firms having preferred stock outstanding during the time period of the study. A common log transformation was applied to all of the financial ratios to improve normality, reduce outliers, and improve the homoscedasticity of the distributions.[3]

The empirical approach employed in this study involved the use of numerical classification procedures which analytically determine classifications or groupings based upon empirical similarities among the objects of interest without consideration of any a priori groupings. The empirically determined classifications should have high internal (within group) homogeneity and high external (between group) heterogeneity. Factor analysis was chosen to determine the empirically based groupings of financial ratios.[4] Factor analysis attempts to account for the covariance (or correlations) of the observed

Table 1: Financial Ratios for Industrial Firms[a]

1. Cash flow/Sales
2. Total income/Sales
3. Net income/Sales
4. Current liabilities/Net plant
5. Current liabilities/Net worth
6. Debt/Net plant
7. Debt/Total capital
8. Total liabilities/Net worth
9. Working capital/Total assets
10. Total assets/Net worth
11. Receivables/Inventory
12. Cash/Total assets
13. Cash/Current liabilities
14. Current assets/Total assets
15. Current assets/Current liabilities
16. Inventory/Current assets
17. Inventory/Working capital
18. Quick assets/Total assets
19. Quick assets/Current liabilities
20. Receivables/Sales
21. Cash/Sales
22. Current assets/Sales
23. Inventory/Sales
24. Quick assets/Sales
25. Quick assets/Fund expenditures
26. Cash/Fund expenditures
27. Cash flow/Total assets
28. Cash flow/Net worth
29. Cash flow/Total liabilities
30. Total income/Total assets
31. Net income/Total assets
32. Net income/Net worth
33. Net income/Total liabilities
34. Net worth/Sales
35. Sales/Working capital
36. Sales/Total assets
37. Cost of goods sold/Inventory
38. Earnings before interest and taxes/Total assets
39. Earnings before interest and taxes/Sales
40. Fixed charges/Earnings before interest and taxes
41. Sales-Cost of goods sold/Sales
42. Sales/Net plant
43. Cash flow/Total capital
44. Total income/Total capital
45. Sales/Total capital
46. Current liabilities/Total assets
47. Debt/Total assets
48. Total liabilities/Total assets

[a]Components of the ratios are defined as:
cash flow = net income + nonrecurring income/expenses + depreciation and amortization;
total income = net income + nonrecurring income/expenses;
total liabilities = current liabilities + long-term debt;
total capital = total invested capital - long-term debt;
working capital = current assets - current liabilities;
quick assets = cash + receivables;
fund expenditures for operations = operating expenses - depreciation;
operating expenses = net sales - (cost of goods sold + operating income); and,
earnings before interest and taxes = net income + fixed charges + income taxes.

variables in terms of a much smaller number of hypothetical variates, or factors. Factor analysis operates on a set of variables so the j observed variables are linearly described in terms of m (usually much smaller than j) common factors and a unique factor (including error). The new coordinates of case i with respect to factor k, F_{ik}, are called factor scores. If x_{ij} is the original value of variable j for case i, then:

$$x_{ij} = a_{j1}F_{i1} + a_{j2}F_{i2} + \ldots + a_{jm}F_{im} + e_{ij}.$$

The a_{jk} terms are called factor loadings; each indicates the importance of the k^{th} factor in measuring variable j. The k factors or groupings may

be either uncorrelated (orthogonal) or correlated (oblique). As long as the factors are uncorrelated, and the original variables are reduced (the variable mean subtracted) and standardized (divided by the variable standard deviation), the factor loading, a_{jk}, represents the correlation between the k^{th} factor and variable j. In the case of correlated (oblique) factors, the factor loading can best be interpreted as an approximation of the correlation of the k^{th} factor with variable j [31:147-48]. In practice, the factor loading, a_{jk}, the m factor groupings, and the unique factor (e_{ij}) are unknown parameters that require estimation from the data.

Specifically, oblique factor analysis techniques were employed in this study to determine the first-order groupings (or factors) of the financial ratios based upon their empirical similarities. The initial data matrices (one for each year) were transformed to a product-moment correlation matrix before factoring. The oblique rotation process employed was the reference factor structure with a biquartimin technique (gamma = one-half), while the number of factors to be extracted was determined by requiring that the eigenvalues of all factors had to be equal to or greater than 1.00.[5]

Subsequent to determining the first-order groupings of financial ratios, the correlation matrix of the groups themselves was factor analyzed to determine the similarities among the first-order financial ratio groups by defining a hierarchy among the financial ratio groups.[6] This hierarchical factor analysis of the first-order financial ratio groups specifies the empirical similarities among the groups and assists in determining interrelationships of financial ratios belonging to different groups. Oblique rotation, rather than the more common orthogonal rotation, was required in the first-order factor analysis to generate the correlation matrix necessary for an analysis of the hierarchical relationships existing among the financial ratio groups.

Empirical Results

Oblique factor analysis of the 48 financial ratios across the 221 industrial firms for 1969 resulted in the identification of seven groupings of financial ratios (Table 2). Ninety-two percent of the common variation among the financial ratios was accounted for by these seven classifications which were descriptively labeled: *Return on Investment, Capital Turnover, Inventory Turnover, Financial Leverage, Receivable Turnover, Short-Term Liquidity,* and *Cash Position.*[7] The labels employed for each classification are intended to represent the predominant (though not necessarily unanimous) thrust of the financial ratios classified in each group. Although many of the groupings were anticipated on the basis of previous research and a priori

Table 2: Ratios and Factor Loadings Defining Seven Classifications of Financial Ratios (1969)

Number	Variable	Factor Loading 1	2	3	4	5	6	7	
2	Total income/Sales	.71							
27	Cash flow/Total assets	.85							
28	Cash flow/Net worth	.91							
30	Total income/Total assets	.89							
31	Net income/Total assets	.89							
32	Net income/Net worth	.96							
38	Earnings before interest and taxes/Total assets	.91							Return on investment
39	Earnings before interest and taxes/Sales	.77							
43	Cash flow/Total capital	.88							
44	Total income/Total capital	.97							
1	Cash flow/Sales		-.78						
14	Current assets/Total assets		.81						
18	Quick assets/Total assets		.77						
34	Net worth/Sales		-.88						
36	Sales/Total assets		.89						Capital turnover
42	Sales/Net plant		.95						
45	Sales/Total capital		.85						
22	Current assets/Sales			.73					
23	Inventory/Sales			.97					
35	Sales/Working capital			-.77					Inventory turnover
37	Cost of goods sold/Inventory			-.97					
6	Debt/Net plant				.73				
7	Debt/Total capital				.99				
8	Total liabilities/Net worth				.76				
10	Total assets/Net worth				.76				Financial leverage
47	Debt/Total assets				.97				
48	Total liabilities/Total assets				.76				
11	Receivables/Inventory					-.99			
16	Inventory/Current assets					.76			
20	Receivables/Sales					-.82			Receivable
24	Quick assets/Sales					-.73			turnover
5	Current liabilities/Net worth						-.71		
15	Current assets/Current liabilities						.91		Short-term
17	Inventory/Working capital						-.76		liquidity
19	Quick assets/Current liabilities						.81		
46	Current liabilities/Total assets						-.78		
12	Cash/Total assets							.91	
13	Cash/Current liabilities							.83	Cash
21	Cash/Sales							.90	position
26	Cash/Fund expenditures							.91	

treatments in the financial literature, some of the empirical results were not expected.

Traditional financial theory suggests the existence of three interrelated types of measures of a firm's activities. These measures can be broadly defined as turnover ratios, profit margin ratios, and earning power (rate-of-return-on-investment) ratios. While the empirical analysis did indicate turnover groupings and a return-on-investment grouping, it failed to suggest a separate profit margin grouping. Moreover, the ratio (net income/sales) generally employed to depict profit margin failed to group into any of the seven empirically determined classifications. Closer examination indicated that the ratio of net income/sales tended to split between the classifications, Return on Investment and Capital Turnover. However, total income/sales, as well as earnings before interest and taxes/sales—ratios which might serve as proxies for the profit margin ratio—grouped into the Return-

on-Investment classification, while a related ratio—cash flow/sales—grouped into the Capital Turnover classification. These results tentatively suggest that the concept of profit margin is not empirically distinguishable from its components, return on investment and capital turnover.

The seven classifications delineated by this study are similar to those suggested in financial theory. Typically, the Financial Leverage classification is recognized as a separate group, but Inventory Turnover, Receivable Turnover, and Capital Turnover are often grouped as a common set [2,5,16,41]. Interestingly, the Capital Turnover classification includes financial ratios that measure both turnover and asset composition characteristics. The financial ratios of current assets/total assets and quick assets/total assets conceptually are more closely related to an asset composition category than to a capital turnover category. However, these two ratios appear to be very similar to the Capital Turnover classification on an empirical basis, as indicated by the size as well as by the signs of their factor loadings. The compositions of the rest of the classifications appear to be reasonably conventional, since many of the groupings indicated by the empirical analysis could be expected on an a priori basis.

In addition to the net income/sales ratio discussed earlier in conjunction with profit margins, seven other financial ratios did not group into specific classifications.[8] The failure of these eight financial ratios to group into a single classification suggests either that the activities of a firm indicated by these ratios can be adequately measured by other financial ratios which do group into specific classifications, or that each of these ratios measures a unique characteristic of a firm's activities and thus lacks empirical similarity with other financial ratios. Three of these ratios, which have been found in other studies [1,2,27,29,35] to have predictive significance, are examined further in the analysis and implications section.

In order to determine the stability of the classifications in terms of the size of the factor loadings and the presence of specific financial ratios in the same classifications over time, factor analyses using the same firms and financial ratios also were run for 1966, 1967, and 1968.[9] The degree of temporal stability of the loadings and classifications was analyzed by: (1) visual comparison; (2) vector comparison involving the calculation of correlation coefficients of the factor loadings of all variables for all factors (Table 3); and, (3) factor analysis of an averaged data matrix for 1966-68. All of these analyses strongly indicated that the classifications were not a unique or random occurrence restricted to 1969.

Higher-order factor analysis was employed to identify the interrelationships among the seven first-order classifications of financial

Table 3: Correlations between Financial Ratio Factor Loadings between Years for Each Factor

Years	Factor						
	One	Two	Three	Four	Five	Six	Seven
1966 and 1967	992	.997	.996	.995	.992	.996	.994
1967 and 1968	995	.995	.993	.992	.997	.994	.994
1968 and 1969	993	.996	.991	.986	.988	.993	.987
1966 and 1969	.989	.995	.995	.988	.989	.992	.990
1966-68 average, and 1969	994	.996	.995	.988	.989	.992	.992

ratios. The results of this factor analysis performed on the correlation matrix among the seven first-order classifications for 1969 are presented in Table 4. Higher-order group one includes the two first-order classifications of Return on Investment and Financial Leverage, and is descriptively labeled *Return on Invested Capital.* Higher-order group two is labeled *Overall Liquidity* and includes the first-order classifications of Capital Turnover, Short-Term Liquidity, and Cash Position. The final higher-order group, labeled *Short-Term Capital Turnover,* includes the first-order classifications of Inventory Turnover and Receivable Turnover. Analysis of the higher-order factor analysis results for the four years (1966, 1967, 1968, and 1969) indicates some instability in the hierarchical relationship of one of the first-order classifications; specifically, Cash Position is associated with higher-order group three (Short-Term Capital Turnover) in 1967 and 1968, while it is grouped with higher-order group two (Overall Liquidity) in 1966 and 1969.[10] The instability of the Cash Position group is viewed as relatively unimportant since this specific first-

Table 4: Classifications and Factor Loadings Defining Three Higher-Order Groupings (1969

Number	First-order Classification	Higher-Order Classification Factor Loading 1	2	3
One	Return on investment	.74		
Four	Financial leverage	-.89	Return on invested capital	
Two	Capital turnover		-.76	
Six	Short-term liquidity		.61	Overall
Seven	Cash position		.82	liquidity
Three	Inventory turnover			-.90
Five	Receivable turnover			.78

Short-term capital turnover

order classification is less meaningful (both theoretically and empirically) than the other first-order groups.

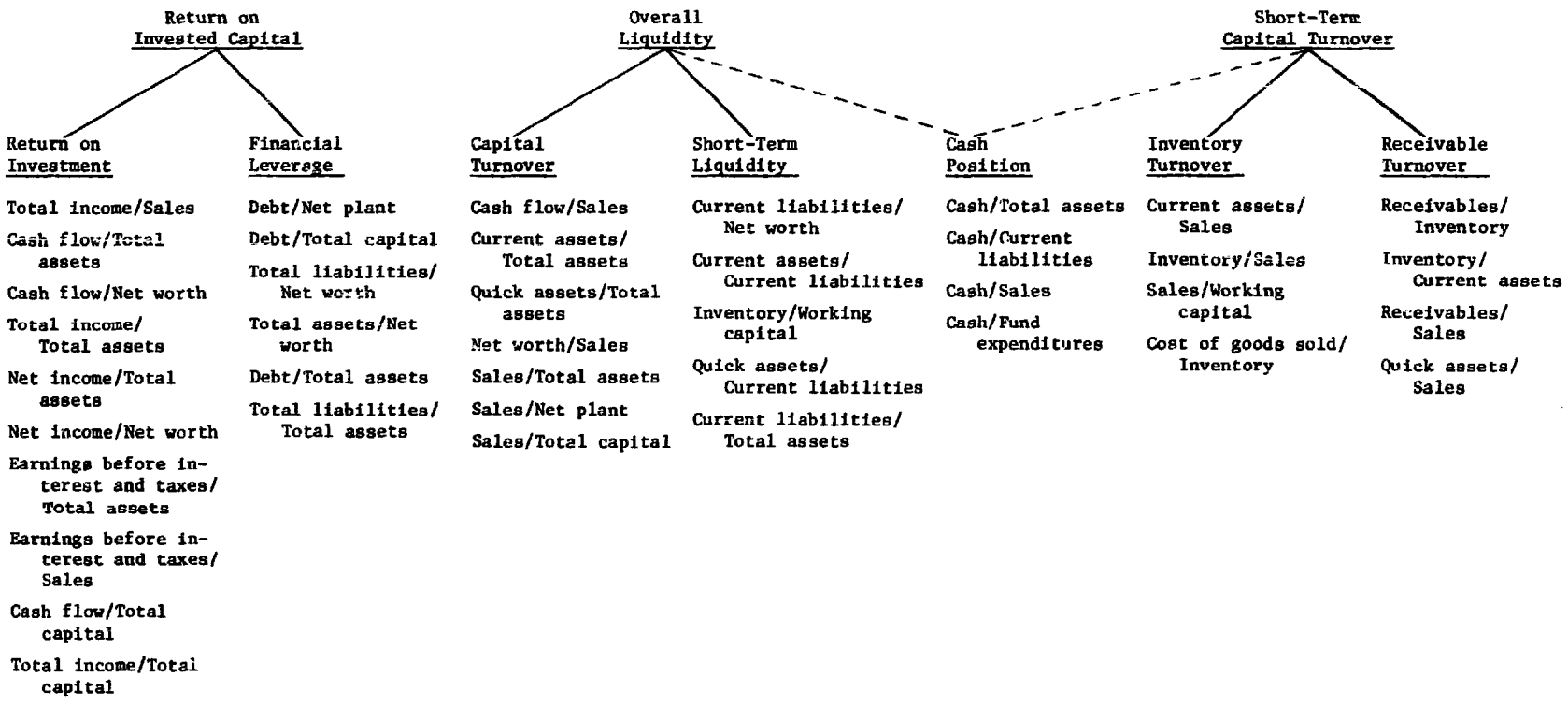
The hierarchical relationships indicated by both the first- and higher-order factor analyses are presented in Table 5. Many of these results were anticipated on an a priori basis; however, some unique relationships were identified by this empirical analysis. While all turnover ratios might be considered conceptually similar, the analysis indicates that they do not measure the same aspects of a firm's operations. The first-order classifications of Inventory Turnover and Receivable Turnover combine in the higher-order analysis to form a group labeled Short-Term Capital Turnover. This higher-order group appears to encompass financial ratios that measure the short-term purchasing and collection activities of industrial firms. However, turnover ratios measuring the longer-term aspects of a firm's operations, which appear in the first-order group as Capital Turnover, combine with the Short-Term Liquidity classification to form a higher-order group labeled Overall Liquidity. This higher-order group appears to encompass financial ratios that depict the asset (or liability) composition characteristics of industrial firms. It also is of interest to note that the two first-order classifications, Return on Investment and Financial Leverage, combine to form the higher-order classification descriptively labeled Return on Invested Capital. This grouping provides an empirical basis for the a priori belief in the interrelationship of a firm's return on investment and its use of financial leverage.

Analysis and Implications

In recent years the predictive power of financial ratios has been the subject of numerous empirical investigations. Advances in knowledge of the predictive ability of certain financial ratios have come forth, but the overall level of understanding has not kept pace due to the difficulties associated with comparing the results from alternative studies. The findings of this study represent a move in the direction of providing greater insights into the empirical similarities among alternative financial ratios as well as of indicating the hierarchical relationships among empirically based financial ratio classifications.

Forty of the 48 financial ratios examined in this study were grouped into seven distinct classifications based upon their empirical similarities. These seven first-order classifications, through the use of higher-order factor analysis, were shown to be interrelated. The three higher-order groupings—Return on Invested Capital, Overall Liquidity, and Short-Term Capital Turnover—were found to be unique in that they provide more comprehensive groupings of financial ratios and assist in specifying the interrelationships that exist among financial ratios and financial ratio groups. The specific financial ratios (those

Table 5: Hierarchical Classification of Financial Ratios for Industrial Firms



with the two highest factor loadings) that most closely depicted the empirically defined financial ratio classifications were:

Return on Investment
- .97 total income/total capital
- .96 net income/net worth

Capital Turnover
- .95 sales/net plant
- .89 sales/total assets

Inventory Turnover
- .97 inventory/sales
- −.97 cost of goods sold/inventory

Financial Leverage
- .99 debt/total capital
- .97 debt/total assets

Receivable Turnover
- −.99 receivables/inventory
- −.82 receivables/sales

Short-Term Liquidity
- .91 current assets/current liabilities
- .81 quick assets/current liabilities

Cash Position
- .91 cash/total assets
- .91 cash/fund expenditures

By selecting one ratio from each classification, researchers and analysts can identify a set of financial ratios which essentially are independent of each other (i.e., have low intercorrelations), but which represent the seven different empirical aspects of a firm's operations identified in the present study. The other financial ratios in each classification have lower factor loadings and, hence, are less descriptive of the empirically based financial ratio groups.

If prediction rather than description (or representation) is the goal, researchers and analysts may find it desirable to select financial ratios employed in previous empirical studies even though they are less descriptive of the financial ratio groups identified in the present study. Recent research on the predictive ability of financial ratios and related financial data has focused primarily on predicting bond ratings and in identifying possible bankruptcy or merger candidates. The financial ratios found to be significant in these studies are presented in Table 6. Inspection of this table indicates that financial ratios falling only into the Return-on-Investment, Capital Turnover, Inventory Turnover, and Financial Leverage classifications have been identified as significant predictors. Three of the financial ratios with high predictive significance—i.e., sales/total assets, debt/total capital,

Table 6: Financial Ratios Identified as Significant Predictors

Financial Ratio Classification	Financial Ratios		
	Factor Loading	Ratio	Study
One: Return on Investment	.91	Earnings before interest and taxes/Total assets	[1]
	.89	Net income/Total assets	[2], [27], [29]
	.77	Earnings before interest and taxes/Sales	[17], [35]
Two: Capital Turnover	.89	Sales/Total assets	[1], [35]
	-.88	Net worth/Sales	[17]
Three: Inventory Turnover	-.77	Sales/Working capital	[17]
Four: Financial Leverage	.99	Debt/Total capital	[17], [29]
	.97	Debt/Total assets	[2], [27], [35]
Ratios that did not group with a classification		Cash flow/Total debt	[2]
		Working capital/Total assets	[1], [35]
		Net income & interest/ Interest	[27], [29]
Ratios not included in the study		Retained earnings/ Total assets	[1]
		Market value of equity/ Total debt	[1], [40]

and debt/total assets—also are the most descriptive of their respective financial ratio groups as identified by the present study.

Further examination of Table 6 indicates that three other financial ratios found to have predictive significance in these previous studies—while included in the present study—did not group into any classification (based on the .70 factor-loading criterion). These ratios are cash flow/total debt, working capital/total assets, and net income and interest/interest. An examination of other factor analysis results (not presented here) indicates that the ratio of net income and interest/interest (as represented in this study by fixed charges/earnings before interest and taxes) was related to both the Return-on-Investment and Financial Leverage classifications; the splitting of this financial ratio between these two groups is consistent with the higher-order factor results which identified a hierarchical relationship between these two financial ratio groups. The working capital/total asset ratio was related to both the Capital Turnover and Short-Term Liquidity classifications, a finding also consistent with the higher-order results. Finally, the cash flow/total debt ratio was related to both the Return-on-Investment and Financial Leverage classifications, as the higher-order factor analysis results suggested. Further examination of Table 6 indicates that two additional ratios found to possess

predictive significance in recent empirical research—i.e., retained earnings/total assets and market value of equity/total debt—were not included in the present study. However, it is believed that both of these ratios are variations of financial ratios that grouped into the **Financial Leverage classification.**[11]

The results of this study should prove useful to researchers as well as to analysts who utilize financial ratios. While many financial ratios are similar in construction, they may not be similar in terms of measuring the same characteristics of a firm's activities. The present study provides information on the functional similarity of various financial ratios by identifying those ratios which are in the same empirically determined classifications. Selectivity may be employed in choosing financial ratios that measure unique aspects of a firm's activities. In this way, a few carefully chosen financial ratios can be selected which will represent virtually all the different aspects of a firm's operations. However, the selection of appropriate ratios also should be based on knowledge of the predictive significance of individual financial ratios. By following this modus operandi, knowledge of the predictive as well as the descriptive ability of individual financial ratios may be combined to facilitate the optimal utilization of financial statement data.

Footnotes

*During the preparation of this article, the late Kent A. Mingo was Associate Professor of Management Science, Oklahoma State University.

[1]Certain new financial ratios proposed in recent years are discussed in [1,2,4,34]. A variety of different ad hoc financial ratio classification systems have been suggested—for example, see [2,5,16,18,39,41].

[2]While only four years of data (1966, 1967, 1968, and 1969) were employed in the present study, companies also had to have the same financial data for the years 1951, 1957, and 1963, so that they could be employed in a previously reported study on the long-term stability of empirically based financial ratio groups [28].

Industrial firms were selected by their COMPUSTAT industry numbers which conform closely with the Standard Industrial Classification (SIC) code. Firms with COMPUSTAT industry numbers 2000 through 3800 were included in the study. This selection requirement excluded firms classified in the following general areas: transportation, utility, finance, service, metal, retail, and conglomerate. Firms also were eliminated due to: (1) the presence of negative data which resulted in negative financial ratios, and (2) the requirement that fixed charges and long-term debt could not be zero more than once for the seven years examined. These selection criteria may have produced a bias in the sample towards profitable, levered firms.

While specific industry analyses were not undertaken, it is believed that results are generalizable for virtually all industrial firms and are not significantly influenced by industry differences.

[3]Considerable skewness existed in the financial ratio distributions before transformation. Plotting, chi-square tests, and Kolmogorov-Smirnov tests conducted after the common log transformation indicated that the resulting distributions were approximately normal for most of the financial ratios employed in the study.

[4]Factor analysis and principal component analysis have been widely employed in recent empirical studies in finance and accounting [8,9,10,11,20,22,25,28]. Factor analysis differs from principal component analysis with respect both to the existence of an error term and to a second rotation which is incorporated in factor analysis, but not in principal component analysis. Factor analysis is discussed in [15,21,26,31]. Cluster analysis also has been employed to group together empirically similar objects [14,19,25]. Cluster analysis has the advantage of enabling all objects to be forced into groups, while factor analysis often produces results in which some objects are not placed into specific groups. However, cluster analysis has the disadvantages of forming groups based on simple Euclidean distances and of being very sensitive to sampling variability. See [26: Chapter 8] for a discussion of the relative stability of groups created through the use of factor analysis and cluster analysis.

[5]The total variation of individual variables can be divided into common and unique (including error) components. Analysis of only that part of the total variance which is common to all variables made possible an examination of the relationships among all of the variables in the common data space. The communality estimates employed were the squared multiple correlation coefficients. All calculations were performed employing BMD 08M [6].

[6]The general topic of hierarchical classification is covered in [33]. Rummel [31] has an excellent discussion of the higher-order factor analysis procedures employed in this study to determine the hierarchical relationships among the financial ratio groups.

[7]Only financial ratios that had factor loadings of .70 or greater were considered. This cutoff, which is higher than that generally required when factor analysis results are interpreted, was employed because the square of this loading times 100 equals approximately 50 percent. Variables with less than 50 percent common variation with the rotated factor pattern were considered too weak to report. While the factor loadings resulting from oblique rotation could not be interpreted strictly as the correlation of a financial ratio with the factor, the oblique factor loadings were very similar in their magnitude to the factor loadings obtained when orthogonal rotation was employed using the varimax rotation on the principal component solution.

[8]These seven financial ratios were: current liabilities/net plant; working capital/total assets; quick assets/fund expenditures; cash flow/total liabilities; net income/total liabilities; fixed charges/earnings before interest and taxes; and sales-cost of goods sold/sales. All of these ratios were associated with one or more of the financial ratio groupings, but not at the .70, or above, factor-loading level.

[9]The amount of total variance explained was 92 percent in 1968 and 93 percent in both 1966 and 1967. The oblique rotation results for 1966, 1967, and 1968, and the orthogonal rotation results for 1966, 1967, 1968, and 1969 are available from the authors. The first-order results were virtually identical whether oblique or orthogonal rotation was employed; however, hierarchical classifications cannot be determined when orthogonal rotation is employed.

[10]The higher-order results for 1966, 1967, and 1968 are available from the authors.

[11]See Stevens [35] for support that the financial ratio—defined as market value of equity/total debt—groups with other financial leverage ratios.

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