Financial Ratio Patterns in Retail and Manufacturing Organizations

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Introduction

A bewildering array of potentially useful financial ratios is available for use. The user, however, will usually want to make decisions based on only a few ratios. For example, Chen and Shimerda [3] identify 41 different ratios that apparently serve some useful predictive or explanatory purpose. This set of 41 ratios is obtained by reviewing 26 previous studies in which a total of 100 ratios are examined. A set of 100 or even 41 financial ratios would be much too cumbersome to be employed in a decision model. Consequently, in several studies [4, 5, 8, 10, 11, 12, 13] an attempt is made to reduce the dimensionality of a variable set by developing patterns among financial ratios via factor analysis.

The purpose of this study is to extend previous studies of financial ratio patterns by examining cross-industry stability of financial ratio patterns. A secondary purpose of this paper is to assess the sensitivity of these patterns to differences in accounting constructs, for example, using net income plus depreciation as a proxy for cash flow. The motivation behind developing financial ratio patterns is discussed in the next section.

Developing Financial Ratio Patterns

Reducing dimensionality of a set of financial ratios centers around developing some sort of structure or grouping system for the ratios. A simple grouping system, such as those employed by introductory Finance texts, can be used to provide some structure to a financial ratio set. For example, Weston and Brigham [14] classify ratios into four groups: liquidity, leverage, activity, and profitability. The user could employ this simple grouping system to eliminate some redundancy among ratios as well as to insure that no important aspect of firm performance is overlooked.

Such a simple *ad hoc* grouping scheme is easy to develop and implement, but presents serious shortcomings for most users of financial ratios. Some ratios are very difficult to classify because they are related to ratios in different groups. Without empirical evalua-

tion of ratio values, inventory turnover or receivables turnover could be classified as either liquidity ratios or activity ratios. *Ad hoc* reasoning also will be unable to determine the similarity or dissimilarity of ratios within groups. For example, both times interest earned and debt/assets are leverage ratios, but they measure slightly different aspects of using debt. Likewise, both return on sales and return on equity are profitability ratios, but they measure slightly different aspects of profitability. Without analyzing empirical relationships among ratios, it cannot be determined whether both belong to one homogeneous group and are essentially redundant, or whether they belong to different groups of ratios.

Analyzing empirical relationships among financial ratios could be performed through correlation analysis. If two ratios are highly correlated, then the user could consider one of the pair to be redundant, discarding it with little loss of information. If two ratios are not highly correlated, then the user could consider each to measure a different aspect of firm performance. Highly correlated ratios could be brought together into groups, where the groups would each measure some different aspect of firm performance. In this way, the user could understand the relationships and patterns among the financial ratios in a variable set. By uncovering the number of homogeneous groups of ratios in a variable set, the size of the variable set could be reduced from the number of original variables or ratios to the number of homogeneous groups.

Instead of the user performing the groupings according to the correlation coefficients, the grouping procedure could be performed via factor analysis. Factor analysis takes a correlation matrix (or covariance matrix) among original variables as input and constructs new variables where the number of new variables (called factors) to be retained is smaller than the number of variables in the original data set. If the correlation coefficient between one of the original variables and a factor is close to unity then that original variable can be used to represent the factor. In this manner, a large set of variables can be reduced to a much smaller set, where the smaller set of variables is then used for some predictive, explanatory, or descriptive purpose.

The user's task is made much easier if relationships or patterns among financial ratios are stable across time and across different companies. In that case, a reduced set of financial ratios obtained from a larger variable set during one time period could be used during other time periods, and for other companies as well. Past research provides evidence of considerable time series stability of patterns among financial ratios. Past research on cross-sectional stability of financial ratio patterns is rather limited, however. A description of previous studies of model reduction in financial ratio sets is provided in the next sections.

Previous Studies

Many previous studies of financial ratio patterns are designed to provide background for other empirical studies employing financial ratios. Pinches, Mingo, and Caruthers (PMC) [11] examined interrelationships among 48 financial ratios for a sample of 221 industrial firms with SIC codes from 2000 to 3800. They found seven groups of financial ratios including: (1) return on investment; (2) capital intensiveness; (3) inventory intensiveness; (4) financial leverage; (5) receivables intensiveness; (6) short term liquidity; and (7) cash position. This grouping among financial ratios is relatively stable over four different time periods and is corroborated for the 1961–69 time period by Pinches, Eubank, Mingo, and Caruthers [12].

Several studies of financial ratio patterns also indicate relationships among financial ratios that are very similar to those found by PMC. Chen and Shimerda reconcile results of PMC with those of Stevens [13] and Libby [10] by providing some evidence that differences are primarily in nomenclature rather than in the patterns themselves. Chen and Shimerda also demonstrate that 10 ratios of value in predicting failure exhibit a high factor loading on factors found by PMC.

Factor Patterns for Retail Firms

An extension of PMC's study, but not examined by Chen and Shimerda, is performed by Johnson [7], who compares financial ratio patterns for industrials with those from retail firms. The original sample of firms studied by PMC contains only industrial firms and does not contain any retail firms. Johnson finds the patterns for retail firms to be very similar to the patterns found by PMC for industrial firms. Johnson's sample period, however, includes only 1972 and 1974. These two years may not be indicative of all years of data for retail firms.

The study of financial ratio patterns for retail firms is motivated by two factors: 1) retail firms can be expected to differ significantly in financial characteristics from manufacturing firms and 2) many studies employing financial ratios are directed toward samples containing substantial numbers of retail firms. Retail firms tend to have much higher turnover ratios, much lower profitability on sales and much shorter operating cycles than primary manufacturing companies. Their

asset structures also differ considerably, with retail firms having proportionately more current assets and proportionately less fixed assets than manufacturing firms. Retail firms and manufacturing firms can therefore be thought of as being at opposite ends of the spectrum of these financial characteristics. If retail firms and manufacturing firms did display similarity in financial ratio patterns then it might be reasonable to assume that firms with financial characteristics lying within these two opposite ends of the spectrum might also have similar patterns.

Cash Flow Ratios

In the Johnson and PMC ratios, as well as all others studied by Chen and Shimerda [3], ratios that are called cash flow ratios are found to group together with profitability ratios. Such results, however, could stem from the use of net income plus depreciation as a proxy for cash flow in all of these studies. Cash flow from operations, properly defined as cash receipts minus cash disbursements, is an accounting construct that differs markedly from profit. The empirical similarity between profitability measures and measures using net income plus depreciation therefore suggests that net income plus depreciation might be measuring profitability instead of cash flow.

Perhaps the reason that net income plus depreciation was used in previous studies instead of cash flow is that cash flow information cannot be obtained simply from most annual reports. According to the Financial Accounting Standards Board [5], ninety-five percent of reporting firms present the Statement of Changes in Financial Position on a working capital basis and five percent present the statement on a cash flow basis. Therefore, only for a small minority of firms can cash flow from operations be read from an annual report. For all other firms, considerable calculations are required.

Whether or not net income plus depreciation may be properly used as a proxy would require either 1) accruals and deferrals other than depreciation are not material or cancel each other out or 2) accruals and deferrals other than depreciation represent a consistent proportion of depreciation. If the first condition holds, then net income plus depreciation would be approximately equal in value to cash flow. If the second condition holds then net income plus depreciation would be highly correlated with cash flow.

Data and Methodology

Firms in the Sample

Firms in the sample belong to one of two broadly defined industry groupings: manufacturing firms and retail firms. Firms with SIC numbers 2100 through 3800 are included in the sample of manufacturing firms. This sample would include textile, apparel, lumber, paper, chemicals, petroleum, rubber, steel, metal, machinery, transportation vehicles, and electronics industries. This group of manufacturing industries corresponds exactly to those studied by Pinches, Mingo, and Caruthers [11]. The retail group, not studied in their article, is composed of companies with SIC codes 5300 through 5900. It includes department stores, grocery stores, shoe stores, furniture stores, and drug stores. The Compustat Annual File contains full information for the 1971–80 period (inclusive) for 783 manufacturing firms and 88 retail firms.[1] These 871 firms over the ten year period beginning 1971 and ending 1980 comprise the sample of firms under study.

Ratios Employed

A list of fifty-eight financial ratios examined in this study is presented in Exhibit 1, together with the mean of each ratio during 1980 for firms in the manufacturing sample and the mean for 1980 for firms in the retail sample.[2] This set of 58 ratios contains all of the ratios studied by Pinches, Mingo and Caruthers. In addition, ratios are constructed using income before extraordinary items and discontinued operations (income) as well as income after extraordinary items and discontinued operations (net income). The set of ratios also contains four ratios with working capital from operations (from the funds statement) in the numerator and four ratios with cash flow in the numerator. For these four ratios cash flow is defined as cash flow from operations, *i.e.*, cash inflows from operations minus cash outflows from operations. This definition is implemented in this study by adjusting net income plus depreciation for all accruals and deferrals, including amortization, extraordinary gains and losses, deferred taxes, equity earnings, changes in accounts and notes receivable, changes in inventory and short term prepayments, changes in accounts and notes payable, and changes in accrued liabilities.

Following the same rationale as the cash flow ratios, fund expenditure (defensive interval) ratios are also

[1]The group of manufacturing firms contains many more observations than the group of retail firms because of the greater incidence of manufacturing firms. Because the two groups are completely different, the size disparity cannot affect the results.

[2]Unlike PMC and Johnson, log transformations are not performed on any ratios. Factor analysis requires no distributional assumptions, allowing usage of non-normally distributed ratios. Also, because no decision model is specified, the variables are not required to take any particular distribution or forms.

Exhibit 1. The Financial Ratios with Mean Values for Each Industry Group

Financial Ratio	Industry Group: Retail	Industry Group: Primary Mfg.
1. Cash/Current Debt	.246	.313
2. Cash/Sales	.024	.054
3. Cash/Total Assets	.066	.072
4. Cash/Total Debt	.117	.170
5. Cash Flow/Equity	.171	.179
6. Cash Flow/Sales	.022	.061
7. Cash Flow/Total Assets	.065	.083
8. Cash Flow/Total Debt	.124	.187
9. Cost of Goods Sold/Inventory	7.642	5.098
10. Cost of Goods Sold/Sales	.759	.711
11. Current Assets/Current Debt	1.957	2.410
12. Current Assets/Sales	.222	.412
13. Current Assets/Total Assets	.576	.593
14. Current Assets/Total Debt	.531	.544
15. EBIT/Equity	.335	.321
16. EBIT/Sales	.047	.102
17. EBIT/Total Assets	.122	.143
18. Income/Equity	.132	.134
19. Income/Sales	.019	.047
20. Income/Total Assets	.051	.065
21. Inventory/Current Assets	.615	.455
22. Inventory/Sales	.132	.188
23. Inventory/Working Capital	1.956	1.070
24. Long Term Debt/Total Assets	.257	.189
25. Quick Assets/Current Debt	.689	1.234
26. Quick Assets/Sales	.084	.212
27. Quick Assets/Total Assets	.207	.302
28. Receivables/Inventories	.478	1.062
29. Receivables/Sales	.060	.158
30. Total Debt/Total Assets	.600	.500
31. Working Capital/Sales	.105	.226
32. Working Capital/Total Assets	.263	.326
33. NIPD/Equity	.240	.227
34. NIPD/Sales	.033	.074
35. NIPD/Total Assets	.088	.103
36. WCFO/Equity	.247	.244
37. WCFO/Sales	.034	.079
38. WCFO/Total Assets	.091	.108
39. NIPD/Total Capital	.224	.205
40. Income/Total Capital	.123	.123
41. Current Debt/Net Plant	1.250	1.040
42. Net Worth/Sales	.150	.328
43. Sales/Total Assets	3.261	1.540
44. Sales/Net Plant	12.087	5.730
45. Sales/Total Capital	9.040	3.346
46. Sales/Working Capital	17.490	6.622
47. Total Debt/Net Plant	1.300	1.010
48. Total Debt/Total Capital	1.737	1.159
49. Total Debt/Net Worth	1.905	1.351
50. Total Assets/Net Worth	2.984	2.479
51. Net Income/Total Assets	.052	.065
52. Net Income/Net Worth	.132	.135
53. Net Income/Sales	.020	.465
54. Current Debt/Net Worth	.997	.701
55. Quick Assets/Fund Exp (Accrual)	.087	.236
56. Cash/Fund Exp (Accrual)	.025	.062
57. Quick Assets/Fund Exp (Cash)	.850	3.015
58. Cash/Fund Exp (Cash)	.217	.665

calculated on a cash basis as well as an accrual basis. PMC use fund expenditures as the denominator of two ratios, where fund expenditures is defined as operating expenses minus depreciation. This calculation includes many other accrual and deferral items. In this study, a cash basis is employed for this calculation: cash outlays for operating expenditures. The accrual-oriented ratios employed by PMC are also included.

Methodology Employed

Classification patterns among financial ratios are developed with factor analysis. This procedure is a multivariate technique that permits economical expression of variation in the variables of a data set by means of a smaller number of factors. In this study it is used to reduce the dimensions of a data set from the number of variables (58) to a much smaller set of factors.

The first step in this procedure is computation of correlation coefficients for all pairs of variables in the data set. This matrix of correlation coefficients is then manipulated to produce a subset of the original data set that retains the maximum amount of information contained in the original data set. Variables within this subset are called factors. Correlation coefficients between original variables and these factors are called factor loadings.

Each factor matrix is rotated according to the varimax rotation procedure. This procedure produces a factor matrix where some variables in the original data set have very high loadings on a particular factor. The factor may then be interpreted by examining the ratios having very high loadings on the factor.

The subset data set could contain as many factors as there are variables in the original data set. The researcher, however, will only want to employ those factors that contribute substantially to explaining variation in the original data set. For purposes of this study, factors with eigenvalues greater than one are selected to represent the original data set. Other factors are discarded.

The factor analysis procedure is carried out separately for retailing and for manufacturing firms for each of the ten years under study, for a total of 20 factor analyses. A cross sectional comparison (across industries within years) of factor patterns is performed

for each of the ten years under study. In order to aid this cross sectional comparison, an examination of time series (within industries across years) stability of ratio patterns is performed. Factor patterns for retail firms are compared for all possible pairs of the following years: 1971, 1972, 1974, 1976, 1978, and 1980. Factor patterns for manufacturing firms are also compared over the same pairs of years for a total of 42 comparisons. Any aberrations in individual years for either group would be important in interpreting cross sectional stability.

The large number of comparisons of factor patterns (20 cross sectional comparisons and 42 time series comparisons) suggests a need for economical representation of similarities or dissimilarities among factor patterns. Comparison of factor patterns is aided by means of a pairwise factorial similarity measure[3] developed by Harmon [6]. This similarity measure, also called a congruency coefficient, is similar in interpretation to a correlation coefficient. A value of 1.0 indicates perfect positive factor similarity, a value of -1.0 indicates perfect negative factor similarity and a value of 0.0 is given by factor patterns completely lacking in similarity.

Results

Means of financial ratios shown in Exhibit 1 provide some preliminary evidence pointing to cross sectional differences. All of the income measures expressed as a percentage of sales are much smaller for retail firms than manufacturing firms. All of the turnover ratios show much higher values for retail firms than for manufacturing firms. Retail firms also tend to show less cash and fewer receivables than manufacturing firms as well as somewhat more debt than manufacturing firms.

Exhibit 1 also provides some preliminary indications of differences between income and cash flow measures. Measures of net income plus depreciation and working capital from operations are both much higher than net income measures. Cash flow from operations measures lie about halfway between those using net income, and net income plus depreciation or working capital from operations. This difference indicates that short term accrual and deferral items, on average, net out to a sum that is about half as much as depreciation and slightly less than half as much as net income. Amounts of this magnitude cannot be dismissed as being immaterial or insignificant, and portend differences in relationships among the ratios.

The factor patterns each year of each group of firms are tabulated in Exhibit 2. Retail and manufacturing firms share several factors including 1) Return on Investment, 2) Cash Position, 3) Financial Leverage, 4) Cash Flow, 5) Receivables Intensiveness, 6) Debt Structure, 7) Cash Expenditures, and 8) Short Term Liquidity. The structure of six of these eight factors for manufacturing firms is similar to the structure described by PMC. The two exceptions, Cash Flow and Cash Expenditures, are not described by PMC or by any other study reviewed by Chen and Shimerda. A significant Cash Expenditures factor is obtained for the manufacturing firms during each of the ten years studied. A significant Cash Flow factor is also obtained for the manufacturing firms during seven of the ten years studied, and is obtained, but not significant during two other years.

The set of retail firms studied is very similar to the set of manufacturing firms with respect to the presence of a specific Cash Flow factor and a Cash Expenditures factor. Like the manufacturing firms, the retail firms always show a significant Cash Expenditures factor. The retail firms also exhibit a Cash Flow factor whose eigenvalue exceeds 1.0 during every year under study.

Many of the other factors obtained for the sample of manufacturing firms are also obtained for the sample of retail firms. Some substantial differences, however, are obtained for factors containing return on sales or inventory turnover ratios. The retail firms sometimes show a Return on Sales factor that is never shown by the sample of manufacturing firms. Even when the separate factor is not found, the return on sales ratios will typically load heavily on the same factor with inventory intensiveness and asset turnover ratios. The factor containing these three types of ratios is referred to in Exhibit 2 as the Turnover factor. This factor is unique to the retailing firms. Its closest counterpart for the manufacturing firms would be the Inventory Intensiveness factor, which is very similar to the inventory intensiveness factor described by PMC for their sample of manufacturing firms.

Some further insight into the structure of these factors is provided by examining factor loadings for a single representative year. These loadings are discussed in the next section.

[3]The congruency coefficient is defined by Harman [6, p. 344] as

$$\phi_{pq} = \frac{\sum_{j=1}^{n} l^{a}_{jp} \cdot 2^{a}_{jq}}{\left(\sum_{j=1}^{n} l^{a2}_{jp}\right)\left(\sum_{j=1}^{n} 2^{a2}_{jq}\right)}$$

where: ϕ_{pq} = the coefficient of similarities between the p^{th} factor of the first data set and the q^{th} factor of the second data set; l^{a}_{jp} = the factor loading for the first data set of the j^{th} variable on the p^{th} factor; 2^{a}_{jq} = the factor loading in the second data set of the j^{th} variable on the q^{th} factor.

Exhibit 2. The Factor Patterns Across Time

Year	Industry	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1971	Manufacturing	Return on Investment	Cash Position	Financial Leverage	Capital Intensive-ness	Inventory Intensive-ness	Receivables Intensive-ness
	Retail	Return on Investment	Turnover	Financial Leverage	Capital Intensive-ness	Receivables Intensive-ness	Cash Position
1972	Manufacturing	Return on Investment	Equity-Financial Leverage	Cash Position	Capital Intensive-ness	Receivables Intensive-ness	Short Term Liquidity
	Retail	Return on Investment	Turnover	Financial Leverage	Capital Intensive-ness	Receivables Intensive-ness	Cash Flow
1973	Manufacturing	Return on Investment	Equity Financial Leverage	Cash Position	Capital Intensive-ness	Inventory Intensive-ness	Short Term Liquidity
	Retail	Financial Leverage	Turnover	Return on Investment	Capital Intensive-ness	Receivables Intensive-ness	Cash Position
1974	Manufacturing	Return on Investment	Financial Leverage	Cash Position	Inventory Intensive-ness	Capital Intensive-ness	Receivables Intensive-ness
	Retail	Return on Investment	Turnover	Receivables Intensive-ness	Capital Intensive-ness	Cash Position	Financial Leverage
1975	Manufacturing	Return on Investment	Cash Position	Equity-Financial Leverage	Capital Intensive-ness	Receivables Intensive-ness	Inventory Intensive-ness
	Retail	Return on Investment	Turnover	Receivables Intensive-ness	Cash Position	Capital Intensive-ness	Financial Leverage
1976	Manufacturing	Return on Investment	Cash Position	Financial Leverage	Capital Intensive-ness	Inventory Intensive-ness	Debt Structure
	Retail	Return on Investment	Receivables Intensive-ness	Financial Leverage	Capital Intensive-ness	Turnover	Cash Position
1977	Manufacturing	Return on Investment	Cash Position	Financial Leverage	Capital Intensive-ness	Inventory Intensive-ness	Short Term Liquidity
	Retail	Return on Investment	Receivables Intensive-ness	Financial Leverage	Capital Intensive-ness	Cash Position	Turnover
1978	Manufacturing	Return on Investment	Cash Position	Financial Leverage	Inventory Intensive-ness	Capital Intensive-ness	Cash Flow
	Retail	Return on Investment	Turnover	Financial Leverage	Capital Intensive-ness	Receivables Intensive-ness	Cash Position
1979	Manufacturing	Return on Investment	Cash Position	Financial Leverage	Receivables Intensive-ness	Capital Intensive-ness	Working Capital
	Retail	Return on Investment	Turnover	Capital Intensive-ness	Financial Leverage	Cash Position	Short Term Liquidity
1980	Manufacturing	Return on Investment	Financial Leverage	Cash Position	Inventory Intensive-ness	Capital Intensive-ness	Short Term Liquidity
	Retail	Return on Investment	Receivables Intensive-ness	Capital Intensive-ness	Cash Position	Turnover	Financial Leverage

Exhibit 2. (Continued)

Factor 7	Factor 8	Factor 9	Factor 10
Cash Flow	Cash Expenditures	Debt Structures	Short Term Liquidity
Cash Flow	Cash Expenditures	Short Term Liquidity	(Return on Sale)
Debt Structure	Inventory Intensiveness	Cash Expenditures	Working Capital
Cash Position	Short Term Liquidity	Cash Expenditures	(Return on Sales)
Cash Expenditures	Debt Structure	Receivables Intensiveness	Cash Flow
Short Term Liquidity	Cash Expenditures	Cash Flow	(Return on Sales)
Cash Flow	Cash Expenditures	Short Term Liquidity	Return on Equity
Debt Structure	Cash Flow	Cash Expenditures	(Debt)
Debt Structure	Cash Expenditures	Short Term Liquidity	Cash Flow
Debt Structure	Cash Flow	Cash Expenditures	Short Term Liquidity
Working Capital	Cash Expenditures	Receivables Intensiveness	Cash Flow
Cash Flow	Cash Expenditures	Debt Structure	(Return on Sales)
Debt Structure	Receivables Intensiveness	Cash Expenditures	Cash Flow
Debt Structure	Cash Expenditures	Cash Flow	Short Term Liquidity
Return on Assets	Receivables Intensiveness	Cash Expenditures	Working Capital
Short Term Liquidity	Cash Expenditures	Cash Flow	(Return on Sales)
Inventory Intensiveness	Cash Expenditures	Cash Flow	Short Term Liquidity
Receivables Intensiveness	Cash Expenditures	Cash Flow	Debt Structure
Debt Structure	Cash Expenditures	Receivables Intensiveness	Cash Flow
Working Capital	Cash Expenditures	Return on Sales	(Cash Flow)

Structure of Individual Factors

Factor loadings for individual financial ratios for 1978 are presented in Exhibit 3. The first factor shown is the Return on Investment factor, which contains income measures as a proportion of assets, equity, and capital. Ratios containing net income plus depreciation show loadings very similar to loadings of ratios containing net income. However, cash flow ratios do not usually load heavily on the same factor as do net income or net income plus depreciation. For retail firms, high loadings of income ratios and income plus depreciation ratios are not paralleled by a similar high loading for cash flow ratios. Rather, cash flow ratios load most heavily on a separate Cash Flow factor for both retail and manufacturing firms. This Cash Flow factor, the fourth factor shown in Exhibit 3, is characterized by very low factor loadings for any of the profitability ratios. The low loading of cash flow/equity on the Cash Flow factor and the high loading on the Return on Investment factor for manufacturing firms is somewhat of an aberration. It occurs in no year other than 1978.

The Turnover factor for retail firms is not very similar to any other factor for manufacturing firms, but is shown paired with the Inventory Intensiveness factor, since at least some ratios are shared. For the retail firms, profit on sales and asset turnover ratios both load very heavily on this factor, as do most of the inventory ratios, including the reciprocals of inventory turnover and current asset turnover. These ratios are scattered among the Inventory Intensiveness, Capital Intensiveness, and Return on Investment factors for manufacturing firms.

The Cash Expenditures factor shown in Exhibit 3 for retail and manufacturing firms indicates the very high factor loadings for the two ratios associated with this factor. When these ratios are calculated on an accrual basis, as is done by PMC [11], the resulting ratios load heavily on the Cash Position and Receivables Intensiveness factors. Neither these accrual basis ratios nor any other ratio consistently loads heavily on the Cash Expenditures factor.

The Working Capital factor contains only two ratios, inventory/working capital and sales/working capital. No other financial ratios load heavily on the factor during the years when it appears as a separate factor.

Also shown in Exhibit 3 is a separate factor for manufacturing firms that is associated with income/assets and income/sales ratios. The appearance of a separate factor for these ratios is somewhat of an aberration. It does not appear for any other year for the manufacturing firms and never appears for the retail firms.

Exhibit 3. The Financial Factors and Factor Loading for Ratios Associated with Each Factor

Factor	Ratio Number	Ratio Name	Factor Loading	
			Retail	Primary Mfg.
Return on Investment	5	Cash Flow/Equity*	.137	.798
	7	Cash Flow/Assets*	.203	.259
	15	EBIT/Equity	.930	.861
	18	Income/Equity	.980	.929
	20	Income/Total Assets	.830	.410
	33	NIPD/Equity	.916	.929
	35	NIPD/Assets	.785	.382
	39	NIPD/Capital	.905	.826
	40	Income/Capital	.967	.840
Cash Position	1	Cash/Current Debt	.939	.901
	2	Cash/Sales	.872	.913
	3	Cash/Total Assets	.922	.902
	4	Cash/Total Debt	.853	.886
	56	Cash/Accrual Exp.	.866	.896
Financial Leverage	30	Debt/Assets	.909	.820
	48	Total Debt/Total Capital	.927	.913
	49	Total Debt/Net Worth	.944	.920
	50	Total Assets/Net Worth	.921	.881
	54	Current Debt/Net Worth	.811	.819
Turnover (Retail)	9	Cost of Goods Sold/INV	−.899	.724
	10	Cost of Goods Sold/Sales	−.711	.151
Inventory Intensiveness (Manufacturing)	12	Current Assets/Sales	.816	−.447
	16	EBIT/Sales	.724	−.063
	21	Inventory/Current Assets	.128	−.792
	22	Inventory/Sales	.864	−.083
	28	Receivables/Inventory	.899	.716
	31	Working Capital/Sales	.716	−.448
	43	Sales/Total Assets	−.869	.208
Capital Intensiveness	13	Current Assets/Total Assets	.800	.730
	14	Current Assets/Total Debt	.821	.823
	24	Long Term Debt/Total Assets	−.709	−.577
	27	Quick Assets/Total Assets	.447	.568
	41	Current Debt/Net Plant	.775	.798
	44	Sales/Net Plant	.680	.730
	47	Total Debt/Net Plant	.685	.537
Cash Flow	5	Cash Flow/Equity	.794	−.390
	6	Cash Flow/Sales	.844	−.593
	7	Cash Flow/Assets	.847	−.547
	8	Cash Flow/Debt	.709	−.417
	18	Income/Equity*	−.019	−.003
	20	Income/Assets*	.145	−.055
	33	NIPD/Equity*	.113	−.0707
	35	NIPD/Assets*	.218	−.028
Return on Assets	19	Income/Sales	n/a†	.849
	20	Income/Assets	n/a	.825
	34	NIPD/Sales	n/a	.794
	35	NIPD/Assets	n/a	.829
Working Capital	23	Inventory/Working Capital	n/a	.965
	46	Sales/Working Capital	n/a	.963
Cash Expenditures	57	Quick Assets/Cash Expenditures	.916	.912
	58	Cash/Cash Expenditures	.949	.920
Return on Sales	16	EBIT/Sales	.40583	n/a
	37	WCFO/Sales	.41641	n/a

*This ratio is not considered to be related to this factor. The factor loading is shown to demonstrate this lack of relationship.

†Not available. This factor does not appear for this industry group for this year.

The results shown in Exhibit 3 indicate some differences in financial ratio patterns between retail firms and manufacturing firms, but only for a single year. In order for these results to be generalizable, the financial ratio patterns for retail firms must be stable over time, as must the financial ratio patterns for manufacturing firms. Evidence on the time series stability of financial ratio patterns is presented in the next section.

Time Series Stability of Financial Ratio Patterns

Pairwise factorial congruency coefficients for pairings of six years during the 1971–1980 period for manufacturing firms[4] are shown in Exhibit 4. This exhibit shows considerable time series stability, evidenced by average coefficients exceeding .95 for several of the factors studied, including Cash Position, Cash Expenditures, Capital Intensiveness and Inventory Intensiveness. The average congruency coefficient for the Return on Investment factor is lower than .90, largely due to the appearance of a separate Return on Assets factor for 1978. The average congruency coefficient of .66 for the Financial Leverage factor stems from the appearance of a separate factor for debt structure in 1972, 1977 and 1980. The average congruency coefficient for the Cash Flow factor is .67. Pairs of years involving 1972 or 1980 show lower congruency ratios. For these two years the Cash Flow ratios also load heavily on the Return on Investment factor.

The last factor shown, the Debt Structure factor, appears as a separate factor during only about half of the years studied. In other years, the Debt Structure ratios load heavily either with the financial leverage ratios or the short term liquidity ratios.

Also shown in Exhibit 4 are pairwise congruency coefficients for selected pairings of years during the 1971 to 1980 period for retail firms.[5] These congruency coefficients indicate an even higher degree of time series stability of financial ratios patterns for retail firms than for manufacturing firms. Seven factors have average congruency coefficients exceeding .90, including Return on Investment, Cash Position, Financial Leverage, Cash Expenditures, Capital Intensiveness, Receivables Intensiveness, and Turnover. The Cash Flow factor shows an average congruency coefficient of .88, still quite high and much higher than the average time series congruency coefficient for the cash flow factor for manufacturing firms. Only the short term liquidity factor indicates a relatively low average congruency coefficient. The structure of this factor is somewhat different during 1976 and 1980 than during other years.

Cross Sectional Stability of Financial Ratio Patterns

Pairwise cross sectional congruency coefficients for each of the years from 1971 to 1980[6] are shown in Exhibit 5. In general, the factors exhibit much less cross sectional stability than they exhibit time series stability. None of the average cross-sectional congruency coefficients exceeds .90. Several of the average congruency coefficients exceed .80, however, including those for Return on Investment, Cash Position, Cash Expenditures, Cash Flow, and Short Term Liquidity. Average congruency coefficients for all other factors exceed .70, with the exception of one factor. This factor contains inventory intensiveness ratios for manufacturing firms but contains inventory, asset turnover, and profitability on sales ratios for retail firms. The low congruency coefficient indicates very little similarity for these two factors.[7]

Summary and Conclusions

Financial ratio analysis begins with selection of a set of financial ratios that is large enough to describe all of the important characteristics of a firm under study, yet small enough to be manageable by the user. Developing this efficiently sized set of financial ratios requires some understanding of relationships among the various financial ratios. Previous research has employed factor analysis to develop groupings or patterns among financial ratios. This considerable research points to considerable time series stability of financial ratios patterns, but very little work has focused on the stability of these patterns across different companies or industries. The primary purpose of this study is to assess the stability of financial ratio patterns across manufacturing and retailing industries. Ancillary to this objective is the assessment of time series stability of financial ratios for these two industries. Additionally, the impact of the definition of cash flow and defensive interval measures upon financial ratio patterns for both

[4]Congruency coefficients for other years are not shown solely because of space limitations. Those shown are largely representative of all years under study. Values for other years are available from the authors.

[5]Comments in footnote 4 also apply to retail firms. Time series stability of factor patterns for retail firms is very important in interpreting cross-industry differences in factor patterns. The smaller sample of retail firms and the large number of variables could cast some doubt on the reliability of results shown for any one year. Evidence of time series stability would lend more credence to results shown in Exhibit 3 for retail firms and also to the interpretation of cross-industry congruency coefficients.

[6]Only the main diagonal of the congruency matrices are shown in Exhibit 5. The full congruency matrices are available from the authors.

[7]The value of .46 is a relatively low congruency coefficient. It is obtained because a very few variables load heavily on both factors and many variables do not load heavily on either factor.

Exhibit 4. Time Series Stability of Financial Ratio Patterns

Year with	Year	Factor: Return on Investment	Cash Position	Financial Leverage	Cash Expenditures	Cash Flow	Capital Intensiveness	Receivables Intensiveness	Short-Term Liquidity	Inventory Intensiveness	Debt Structure
Manufacturing Firms											
1971	1972	.894	.950	.678	.981	.613	.955	.982	.969	.981	.904
	1974	.926	.966	.822	.968	.883	.933	.972	.958	.975	.366
	1976	.852	.901	.888	.986	.905	.935	.952	.703	.939	.382
	1978	.800	.945	.873	.990	.605	.912	.962	.718	.980	.293
	1980	.926	.965	.610	.992	.876	.926	.962	.965	.985	.782
1972	1974	.966	.978	.797	.973	.550	.927	.981	.963	.965	.415
	1976	.962	.895	.417	.968	.508	.926	.962	.681	.948	.452
	1978	.559	.988	.638	.976	.148	.885	.974	.774	.977	.343
	1980	.951	.976	.043	.983	.480	.949	.976	.955	.984	.924
1974	1976	.966	.902	.734	.960	.881	.992	.968	.679	.956	.074
	1978	.646	.971	.688	.962	.660	.982	.987	.759	.977	.023
	1980	.955	.984	.359	.974	.880	.968	.989	.964	.968	.451
1976	1978	.934	.934	.954	.993	.621	.984	.974	.386	.969	.974
	1980	.939	.915	.699	.981	.895	.954	.963	.665	.944	.399
1978	1980	.944	.981	.677	.990	.680	.934	.976	.736	.984	.265
All Years		.88	.95	.66	.98	.67	.94	.97	.79	.97	.47
Retail Firms											
1971	1972	.968	.979	.925	.969	.898	.861	.979	.890	.979	N/A
	1974	.950	.960	.913	.911	.929	.950	.972	.701	.976	.446
	1976	.947	.969	.918	.933	.959	.963	.963	.537	.961	.522
	1978	.966	.951	.947	.936	.931	.942	.955	.706	.966	N/A
	1980	.922	.972	.918	.953	.826	.950	.916	.692	.935	N/A
1972	1974	.950	.972	.959	.879	.875	.760	.989	.546	.950	.193
	1976	.971	.972	.943	.901	.933	.788	.981	.396	.960	.311
	1978	.974	.940	.952	.938	.844	.903	.971	.738	.965	N/A
	1980	.901	.976	.934	.946	.762	.887	.953	.670	.937	N/A
1974	1976	.946	.981	.959	.936	.944	.968	.987	.493	.957	.870
	1978	.936	.943	.953	.847	.935	.881	.978	.403	.934	N/A
	1980	.947	.962	.947	.886	.769	.903	.959	.424	.931	N/A
1976	1978	.971	.952	.960	.839	.940	.907	.972	.405	.962	N/A
	1980	.931	.974	.953	.884	.808	.935	.964	.437	.956	N/A
1978	1980	.924	.972	.977	.953	.854	.972	.978	.918	.967	N/A
All Years		.95	.97	.94	.91	.88	.91	.97	.60	.96	N/A

retail and manufacturing firms is also studied.

The groupings of financial ratios for manufacturing firms is very similar to groupings obtained by Pinches, Mingo and Caruthers [11] as well as several other studies reported by Chen and Shimerda [3]. The seven factors found by Pinches, Mingo and Caruthers for manufacturing firms correspond to seven specific factors studied in this paper. In addition to these seven factors two other factors appear in almost all years studied. One is a Cash Expenditures (defensive interval) factor and the other is a Cash Flow factor. In previous studies, measures of cash flow and defensive interval were calculated using proxies for cash flow and cash expenditures, namely net income plus depreciation and operating expenses, respectively. Appearance of separate factors for cash flow and cash expenditures point to the empirical materiality of accrual and deferral items other than depreciation as well as the empirical materiality of the difference between expenses and expenditures. Such results should at least caution researchers or other users interested in cash flow performance against using simple proxies for the

Exhibit 5. Cross Sectional Stability of Financial Ratio Patterns

Year	Return on Investment	Cash Position	Financial Leverage	Cash Expenditures	Cash Flow	Capital Intensiveness	Receivables Intensiveness	Short-Term Liquidity	Inventory Intensiveness	Debt Structure
1971	.944	.914	.833	.903	.896	.887	.741	.901	.466	.695
1972	.775	.873	.474	.912	.390	.694	.704	.803	.337	.538
1973	.602	.850	.406	.904	.924	.857	.688	.905	.328	.669
1974	.900	.848	.668	.830	.858	.904	.721	.668	.527	.217
1975	.926	.870	.680	.681	.902	.786	.724	.851	.518	.786
1976	.916	.813	.866	.753	.926	.886	.725	.437	.522	.376
1977	.933	.839	.714	.808	.876	.869	.725	.691	.436	.867
1978	.905	.833	.932	.890	.732	.916	.732	.468	.498	.606
1979	.968	.892	.944	.871	.952	.888	.718	.810	.455	.944
1980	.834	.910	.600	.919	.838	.862	.744	.714	.529	.507
All	.87	.86	.71	.85	.83	.85	.72	.72	.46	.62

cash flow construct or using expenses, an accrual concept, as a proxy for expenditures, a cash concept.

The factor patterns for manufacturing firms exhibit considerable time series stability over the period studied, another point of agreement with previous studies. The retail firms also exhibit considerable time series stability of their factor patterns. If anything, the time series stability of factor patterns for retail firms exceeds the stability for manufacturing firms.

The structure of financial ratio patterns does differ somewhat between retail and manufacturing firms. The cross-sectional factor stability measures tend to be much smaller than the time-series measures. In particular, retail firms show return on sales, inventory intensiveness, and asset turnover measure loading heavily on one single factor. Return on sales measures for manufacturing firms always load together on the same factor with return on assets measures. Moreover, return on sales, return on assets, and return on equity usually load together on the return on investment factor for manufacturing firms.

Results of this study point to the suggestion that users analyzing financial characteristics of retail firms might want to use some different ratios or some ratios differently than if analyzing manufacturing firms. For manufacturing firms there appears to be little need to examine return on sales separately from other profitability ratios. However, for retail firms, return on sales should be analyzed separately from profitability ratios. A list of ratios useful for analyzing retail firms should include income to sales as well as income to assets or income to equity, whereas for manufacturing firms, income to sales might not provide any additional information. Inventory turnover also has different meaning for retail firms than for manufacturing firms. It has overtones of profitability for retail firms, whereas for manufacturing firms, it is most closely associated with the structure of the firm's working capital.

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