An Examination of Quarterly Financial Ratio Stability: Implications For Financial Decision Making

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Abstract

This paper examines the underlying dimensions of financial ratios derived from quarterly and annual financial information. Forty four ratios were factor analyzed to determine their underlying dimensions. The results indicate that 12 dimensions underlie ratios developed from both quarterly and annual financial information. This finding differs from the seven factors consistently described for annual financial ratios in prior research. Comparison of these results and their implications are presented.

I. Introduction

Quarterly and annual financial reports are the source for a variety of financial ratios useful for making decisions related to the explanation and prediction of firm performance. Previous research has provided evidence that financial ratios derived from available annual financial information can be classified into seven underlying dimensions (Chen and Shimerda, 1981). Prior research has also indicated that these seven dimensions (factors) are stable over time (Pinches, Eubank, Mingo and Caruthers, 1975; Pinches, Mingo and Caruthers, 1973) and are consistent across a number of industry groupings (Ketz, Doogar and Jensen, 1990). Little research has been conducted to establish that the information provided in quarterly reports has similar characteristics. The primary purpose of this study is to provide an assessment of the stability of the underlying dimensions of financial ratios obtained from quarterly information. A second purpose of this study is to compare the quarterly dimensions with those obtained from annual information.

The stability of quarterly financial information is important since interim information is relied on by investors and analysts as a source of timely information concerning a company's operating results and financial health. The stability of quarterly financial information may be affected by considerations that diminish the quality of interim reporting. One such consideration is that organizational resources dedicated to providing interim data may be limited. A second element associat-

ed with quarterly reporting is that audit involvement is not as extensive as that in annual reporting, which may result in short cuts being taken that affect the quality of quarterly reporting.

An additional element that could affect the quality and stability of quarterly reporting is the potential for income smoothing. Management may have incentives to record accounting accruals or deferrals or to alter business activity in order to present results in what is perceived by the manager to reflect the most favorable position. Motivation for such action may be to influence or manage the information provided to the financial markets. Evidence provided by Mendenhall and Nichols, 1988 suggests that managers have and use considerable leeway in the reporting of interim results. The time period in which management elects to record income smoothing accruals and deferrals is a third consideration which may affect the stability of quarterly reporting.

Additional studies have examined the quality of quarterly information in both the finance and accounting literature. The finance literature has typically examined the volatility of quarterly sales and earnings information (Fabozi and Fonfedder, 1983; Newell, 1969) and window dressing in the balance sheet (Allen and Saunders, 1992; Bildersee and Kahn, 1987). Accounting research has primarily focussed on the predictive ability of interim sales and earnings data using time series analysis (Abdel-Khalik, 1978; Brown, Hughes, Rozeff and

VanderWeide, 1980; Coates, 1972; Collins, Hopwood, and McKeown, 1984; Foster, 1977).

The present study investigates the quality of quarterly information from a more inclusive set of financial data than that in prior research. Specifically, this study provides a preliminary assessment of the stability of underlying factors derived from a set of 44 financial ratios. This approach is similar to that used to assess the stability of underlying dimensions of annual data (Gombola and Ketz, 1983; Ketz, Doogar and Jensen, 1990; Pinches, Eubank, Mingo and Caruthers, 1975; Pinches, Mingo and Caruthers, 1973). Stability is evaluated by determining whether principal component factors derived from quarterly financial ratios are consistent across quarters and are consistent with factors derived from annual information. Evidence of stability of these underlying dimensions could be used to support the use of key ratios by managers and analysts to assess the dimensions of an organizations activities. Failure to find this stability would be an indication that the apparent lack of quality in quarterly financial information is more widespread than the limited areas examined in prior research.

The results of this study indicate that 12 factors underlie both annual and quarterly financial ratio data. The quarterly factors are shown to differ significantly across quarters. In addition, this study provides evidence that the highest percentage of variance in financial information is represented by different factors when comparing quarterly and annual results.

The remainder of this paper is divided into five sections. The first section presents previous research related to factor analysis of financial ratios. Data selection and screening procedures are presented in the second section. The remaining sections present the method of analysis, results and the discussion and conclusions.

II. Background

In a review of 26 studies which utilized financial ratios, Chen and Shimerda, 1981 identified 41 annual financial statement ratios that were reported to be useful. Users of financial ratios would almost certainly prefer a smaller set of financial ratios than 41 that still provides the same information as the larger set. One method of identifying a smaller set of financial ratios is to classify the ratios into similar groups and choose a ratio most indicative of that group.

Several studies have used factor analysis to identify common dimensions of financial ratios (Gombola and Ketz, 1983; Libby, 1985; Pinches, Eubank, Mingo and Caruthers, 1975; Pinches, Mingo and Caruthers, 1973;

Stevens, 1973. Using the underlying financial statement factors Stevens, 1973 selected the highest loading variable to predict merger candidates. Libby, 1985 used a similar procedure in determining which ratios to provide decision makers who were asked to identify bankrupt firms. Pinches, Eubank, Mingo and Caruthers, 1975 (PEMC) and Pinches, Mingo and Caruthers, 1973 (PMC) looked at the stability of these factors over time for industrial firms. Gombola and Ketz, 1983 extended factor analysis of financial ratios to non-industrial firms with similar results. Ketz, Doogar and Jensen, 1990 (KDJ) found the same seven factors existed when examining differences between industries. All of these studies reported results using ratios calculated from annual financial statement data.

The studies by PEMC and PMC found that 48 ratios constructed from annual data could be reduced to seven underlying factors when subjected to principal component analysis. More importantly, these authors found these seven factors to be stable over the time period 1951 - 1969. Extensions of these studies using the same approach indicate that the same seven factors remained relatively stable in annual data through 1985[1].

III. Data Selection and Screening Procedures

The financial ratios that were analyzed in this study were the 44 financial ratios presented by PMC[2]. The ratios were calculated for each quarter in the six years from 1985 through 1990 for all industrial firms (Standard Industrial Classification (SIC) codes from 2000 to 3800). The information used in the computation of these ratios was obtained from the Standard and Poors COMPUSTAT data files. Appendix 1 presents a listing of the ratios and data items used for the ratio calculations.

Screening procedures resulted in the elimination of firms that did not have complete data necessary for computation of the 44 quarterly and annual ratios in each of the six years. The resulting number of firms in the sample was 328. A combined annual analysis was based on factors derived from the ratios of these 328 firms for the six years or a combined total of 1,968 observations. Similarly, a combined quarterly analysis was derived from the four quarterly observations in each of the six years for the 328 firms, this analysis contained 7,862 observations. Finally, factors were also derived by combining ratios from each specific quarter (one through four) for the six years resulting in 1,968 observations for each quarter. The number of observations easily exceeds a minimum of five per variable (220 for the 44 ratios in this study) necessary for stable factor results as suggested by Gorush, 1983.

IV. Analysis

The 44 ratios calculated for the sample firms were subjected to principal component analysis. Principal component analysis is a statistical technique useful for reducing the number of variables under consideration to a smaller number of factors while retaining the maximum amount of information contained in the original variables. Consistent with KDJ, this study used an orthoblique rotation of the initial principal component results to improve interpretation of the factors[3].

When using principal component analysis, determining the number of factors to include in the final analysis is a major consideration. Factor retention decisions can be based on underlying theoretical relationships in the data, prior empirical research using the same data, an eigenvalue criterion, or scree plots. Prior research using annual ratios, including KDJ, PEMC, and PMC report the results of extracting seven factors. These seven were supported by selecting factors with an eigenvalue greater than one.

Chen and Shimerda, 1981 reviewed a number of papers that used factor analysis in selecting ratios as a basis for analysis of bankruptcy. Their results indicated that, of five studies which used factor analysis to reduce ratios to a smaller number of underlying dimensions, 12 factors were identified in total. Analysis of the 12 factors by the authors and additional empirical work indicated that several of the factors differed in name only, or could be attributed to differences in the type and number of variables included in the analysis. The authors concluded that the 12 factors identified in previous research could be included in the seven factors reported by PEMC and PMC.

V. Factor Results

Analysis of the data in this study leads to the retention of a greater number of factors than presented in prior research. Table 1 presents a listing of eigenvalues resulting from the principal component extraction for each of the analyses. Using the eigenvalue criterion, 12 factors should be retained for the annual results. The combined quarterly results indicate that 13 should be retained. The quarter by quarter presentation indicates that 12, 13, 11, and 12 should be retained in the first

Table 1
Summary of Eigenvalues from Principal Component Extraction

Factors	Annual	Combined Quarterly	Q1	Q2	Q3	Q4
1	7.89	7.29	8.11	7.18	8.22	7.48
2	7.72	6.72	7.25	6.80	7.68	7.03
3	4.78	5.47	6.78	5.72	6.06	5.49
4	3.27	3.06	2.97	3.65	2.97	4.17
5	3.11	2.94	2.56	2.98	2.82	3.09
6	2.47	2.29	2.39	2.37	2.35	2.28
7	1.92	2.00	1.96	1.98	2.04	2.01
8	1.81	1.79	1.82	1.82	1.83	1.84
9	1.77	1.70	1.72	1.74	1.74	1.77
10	1.59	1.49	1.57	1.57	1.39	1.48
11	1.33	1.32	1.24	1.52	1.30	1.34
12	1.11	1.13	1.03	1.33	0.98	1.26
13	0.96	1.06	0.89	1.04	0.93	0.90
14	0.87	0.94	0.64	0.82	0.73	0.78

through fourth quarters, respectively. The shaded cells of Table 1 represent factors with eigenvalues lower than the customary cut-off value of one. Based on an assessment of the eigenvalues, we concluded that 12 factors should be retained.

The increase in the number of factors being retained from 7 to 12 warrants further discussion. Previous research by PEMC and PMC which established seven factors and later confirmed by Chen and Shimerda, 1981 relied on log transformations of the data to improve normality. This transformation resulted in the exclusion of firms with non-positive financial ratios from the sample. In a period in which a significant number of potential sample firms have non-positive ratios due to operating losses or negative cash flows the resulting sample may not be representative. To determine the potential risks associated with using variables that violate normality and to compare our results with those from previous research we eliminated the firms with negative and zero ratios from our sample. Factor analysis was then performed utilizing the remaining firms with and without log transformation of the ratios. Analyses of both transformed and non-transformed ratios yielded seven factors similar to those reported in the earlier research. These results are consistent with a number of more recent studies that show many interdependence methods, including principal component analysis, are quite robust with respect to non-normality. See in particular, Nunnaly, 1978 and Stewart, 1981.

These results have two implications. First, the findings indicate that factors are not substantially affected by log transformations in this setting. Prior research may have been unduly influenced by a concern for non-normality in the data. The second implication is that the increase in factors from seven to twelve may be the result of admitting firms with negative financial ratios. Further, in a period when losses, negative operating income or cash flows are not unusual, such an approach could easily result in a sample of firms that were not representative.

The twelve factor solution is also inconsistent with the findings of KDJ who did not use log transformations on the data and included firms with non-positive ratios yet reported seven underlying factors. In their research KDJ analyzed 32 ratios. Our results were compared with those of KDJ by analyzing the same 32 ratios for the 328 firms in our sample. The results of this analysis yielded 7 distinct factors similar to those reported by KDJ. This finding indicates that KDJ's results differ from those reported in this study as a result of the number of ratios included in the analysis. KDJ limited their study to 32 ratios to enable factor solutions at an industry level on a year by year basis. This study used a broader set of ratios that may be more representative of the potential information that can be derived from the financial statements.

The factor results in this study indicate that by retaining twelve factors, a large portion of the variance in the ratios is explained. In the annual sample, 88.1 percent of the variance is explained. In the combined quarterly analysis, 84.6 percent of the variance is explained and 89.5, 87.8, 89.5, and 89.2 percent of the quarterly sample variances are captured in the analyses, respectively.

PEMC and PMC report that the seven factor results explain from 87 to 92 percent (mean of 90.5 percent) of the variation in the four years studied. When firms with non-positive ratios were excluded from the sample reported in this study seven factors similar to those in the earlier research were retained. These factors explained 89.5 percent of the variance. KDJ report year by year percent of variance explained ranging from 89 to 92 percent with a mean (not presented) of 90 percent. If the analysis of all firms including those with non-positive ratios reported in the present study included just the seven highest ranking factors the variance explained dropped to 71 percent in the combined annual data. The resulting drop for quarterly data is 68 percent in the combined quarterly results and to 73, 70, 73, and 72 percent in the first through fourth quarters, respectively.

Communalities provide a measure of the amount of variance on a variable accounted for by the set of factors. These were greater than .70 for 93% of the ratios when combining each of the six periods (combined annual, combined quarterly, and the four quarters). In addition, 83% of communalities were in excess of .80. These high communality values provide evidence that the 44 ratios can be described by a smaller set of underlying dimensions such as that derived from principal component analysis. The combined quarterly analysis yielded 6 ratios with communalities below .7 while the combined annual had 2 and quarters one through four had 2, 4, 3 and 2 ratios, respectively, with communalities below .7. Only ratios 20 and 25 had communalities below .7 in more than one period. Each of these had low communalities in 4 of the 6 periods analyzed[4].

Combined Quarterly and Annual Factors

Table 2 presents the twelve rotated factors for the combined quarterly and annual analysis. A ratio is presented in Table 2 if it had a factor loading of at least .70 for either the combined quarterly or annual results. Loadings in the other period are listed only if they were greater than .49. Factor loadings marked with a star indicate the ratios that had higher loadings on a different factor. The factors are ordered in accordance with

the percent of variance explained in the combined quarterly analysis. Factor names were selected based on the common characteristics of the highest loading ratios[5].

Inspection of the twelve factors presented in Table 2 indicates that all factors except number 9 have common elements in the combined quarterly and annual analysis. The factors were named as follows:

Table 2[a]
Combined Quarterly and Annual Factors

FACTOR Ratio	Combined Quarterly Loading	Annual Loading	FACTOR Ratio	Combined Quarterly Loading	Annual Loading
FACTOR 1: Leverage			**FACTOR 6: Return on Assets**		
8 Total Liab./net worth	0.98	0.99	36 EBIT/tot. assets	0.94	0.86
10 Total Ass./net worth	0.98	0.99	30 Net Income/tot. assets	0.93	0.90
41 Sales/total capital	0.96		37 EBIT/sales	0.82	0.91
42 Cur. Assets/tot. capital	0.95		3 Net Inc./sales	0.76*	0.90
5 Cur. Liab./net worth	0.92	0.99	27 Cash flow/tot. assets	0.70*	0.88
7 Debt/total capital	0.57		29 tot. Inc./tot. assets	0.70*	0.85
FACTOR 2: Current Asset Turnover			**FACTOR 7: Inventory Turnover**		
21 Cash/Sales	0.95	0.98	11 Receivables/inventory	0.98	0.98
24 Quick Assets/Sales	0.95	0.98	35 COGS/inventory	0.98	0.98
22 Current Assets/Sales	0.95	0.98			
13 Cash/Current Liab.	0.94	0.96	**FACTOR 8: Working Capital Turnover**		
19 Quick Assets/cur. liab.	0.92	0.96	17 Inventory/working capital	0.95	0.95
32 Net Worth/sales	0.82	0.85	33 Sales/working capital	0.95	0.95
15 Current Ass./cur. liab	0.78	0.93			
			FACTOR 9Q: Inventory Intensity		
FACTOR 3: Return on Sales			16 Inventory/current assets	0.90	
1 Cashflow/sales	0.87	0.69	23 Inventory/sales	0.77	
2 Total Income/sales	0.87	0.70	**FACTOR 9A: Capital Ratio**		
3 Net Income/sales	0.83	0.67*	41 Sales/total capital		0.98
29 Total Income/tot. assets	0.75	0.59*	42 Current Assets/total capital		0.94
9 Working Capital/tot. assets	0.74	0.94	7 Debt/total capital		0.93
27 Cashflow/total assets	0.73	0.56*			
44 Total Liab./total assets	-0.70	-0.84	**FACTOR 10: Debt Ratio**		
			43 Debt/total assets	0.86	0.83
FACTOR 4: Return on Equity			6 Debt/plant	0.82	0.86
39 Cashflow/total capital	0.95	0.90			
28 Cashflow/net worth	0.94	0.95	**FACTOR 11: Cash Turnover**		
40 Total Income/total capital	0.89	0.95	26 Cash/fund expenditures	0.87	0.87
31 Net Income/net worth	0.65	0.94	25 Quick assets/fund expend.	0.76	0.75
			12 Cash/total assets	0.54*	0.84
FACTOR 5: Fixed Asset Turnover			16 Inventory/current assets		-0.77
14 Current Assets/total assets	0.85	0.82			
18 Quick Assets/total assets	0.83	0.69	**FACTOR 12: Sales Velocity**		
38 Sales/net plant	0.74	0.79	34 Sales/total assets	0.76	-0.65
4 Current Liab./net plant	0.65	0.79	20 Receivables/sales	-0.73	0.74
12 Cash/total assets	0.60		23 Inventory/sales	-0.51*	0.70

[a]   * indicates these ratios loaded higher on other factors.

Blanks indicate that the ratios did not load greater than .49 on these factors.

1. Leverage (8)
2. Current Asset Turnover (1)
3. Return on Sales (7)
4. Return on Equity (6)
5. Fixed Asset Turnover (4)
6. Return on Assets (2)
7. Inventory Turnover (9)
8. Working Capital Turnover(10)
9Q. Inventory Intensity
9A. Capital Ratio (3)
10. Debt Ratio (11)
11. Cash Turnover (5)
12. Sales Velocity (12)

Factor 9 in the combined quarterly analysis (9Q above) was labeled Inventory Intensity whereas the annual analysis produced a different factor dominated by total capital and its relationships with sales, current assets and debt.

To ascertain the potential variation in importance of the factors in the analyses presented above, we also

compared the ordering of the rotated factors in the quarterly and annual settings. The rank order of the factors in the annual analysis is shown in the listing of factor names above in the parenthetical notation following the factor names. In the quarterly analysis, the order is as indicated in the listing above with the top three factors explaining 14.5, 12.0 and 8.4 percent of the variance in the underlying variables, respectively. In the annual analysis, the rank of the factors is materially different, with Current Asset Turnover, Return on Assets, and Capital Ratio the most important, explaining 13.9, 9.0, and 8.9 percent of the variance in the underlying variables, respectively.

Closer examination of the three most important quarterly and annual factors yields some interesting observations. The quarterly Leverage factor is comprised of elements from two annual factors, the annual Leverage factor and the annual Capital Ratio factors. This finding indicates that while Leverage is representative of only one dimension in the quarterly data it represents two distinct dimensions in the annual data.

Table 3
Comparison of the Number of Ratios Loading on Annual and Combined Quarterly Factors.[a]

Number of Ratios Annual Factor		Combined Quarterly Factor												
		1	2	3	4	5	6	7	8	9	10	11	12	Total
1	Leverage	3												3
2	Cur. Asset Turnover		7											7
3	Return on Sales			4										4
4	Return on Equity				4									4
5	Fix. Asset Turnover					3								3
6	Return on Assets			5			3							8
7	Inventory Turnover							2						2
8	W/Cap. Turnover								2					2
9	Capital	3												3
10	Debt Ratio										2			2
11	Cash Turnover					1				1		2		4
12	Sales Velocity									1			1	2
	Total	6	7	9	4	4	3	2	2	2	2	2	1	44

[a] This table presents the number of ratios with Annual loadings $\geq$ .70. On diagonal numbers represent agreement in factor classification, whereas, off diagonal numbers represent difference in factor classification.

The current asset turnover factor is consistent in both the quarterly and annual data. Finally, while quarterly return on sales and return on assets share some common ratios (net income/sales, cashflow/total assets and total income/total assets) their importance to these factors is mixed. Although there are some items in common, the change in importance and composition of factors appears to provide evidence of differences in the information provided by quarterly and annual data.

An alternative comparison of the quarterly and annual factors is presented in Table 3. This table presents a summary of the number of ratios loading on each factor in the quarterly and annual analyses. The table indicates the number of ratios that loaded on the annual factors with loadings greater than .7 and identifies which factors those same ratios loaded on in the combined quarterly analysis.

The numbers on the diagonal represent the number of ratios that loaded on the same factor in both the combined quarterly and combined annual analyses. Variation is indicated by the number of ratios off the diagonal. Eleven of the 44 ratios (25%) are off the diagonal. Most significant differences are in switches between Return on Sales and Return on Assets (5 ratios) and Leverage and Capital (3 ratios).

A summary of the eleven ratios changing factors is as follows:

In the annual Return on Assets factor, three ratios are consistent with the combined quarterly analysis results but five ratios are classified in the quarterly Return on Sales factor. These were net income/net worth, cashflow/total assets, total income/total assets, cashflow/sales, and total income/sales.

The annual Capital Ratio factor has no corollary in the quarterly analysis as the ratios forming this factor come out of the quarterly factor 1 - Leverage. These were sales/total capital, current assets/total capital, and debt/total capital.

In the annual Cash Turnover factor, two of the four ratios "stay home" whereas one goes to the unique quarterly factor, - Inventory Intensity - inventory/current assets - and the other - cash/total assets - is weakly associated with the quarterly Fixed Asset Turnover factor.

The annual Sales Velocity factor includes one ratio - inventory/sales - from the quarterly Inventory Intensity factor.

The changes observed indicate that there are some potentially significant variations between annual and quarterly information.

The use of an orthoblique rotation results in factors that are not independent of each other. None of the factors in this study have interfactor correlations higher than .54. This low level of interfactor correlation provides an indication that switches between factors were unlikely to be an artifact of the statistical method.

Quarterly Factors

To gain an improved understanding of the nature of the quarterly factor structure, the quarter by quarter analysis is presented in Table 4. Twelve rotated factors are shown for each individual quarter and the combined quarterly analysis. Similar to Table 2 above, a ratio is presented in Table 4 if it had a factor loading of at least .70 for either the combined or one of the quarters. Loadings in the other periods are listed only if they were greater than .49. Factor loadings marked with a star indicate the ratios that had higher loadings on a different factor in the same time period. The factors are ordered in accordance with the percent of variance explained in the combined quarterly analysis. Factor names were selected based on the common characteristics of the highest loading ratios.

Inspection of the twelve factors presented in Table 4 indicates that factors 9 and 12 in the combined quarterly analysis do not have consistent corollaries in the quarters. In addition, three unique factors appear in the individual quarters.

The factors were named as follows:

1. Leverage
2. Current Asset Turnover
3. Return on Sales
4. Return on Equity
5. Fixed Asset Turnover
6. Return on Assets
7. Inventory Turnover
8. Working Capital Turnover
9. Inventory Intensity
10. Debt Ratio
11. Cash Turnover
12. Sales Velocity
13. Working Capital Intensity
14. Current Ratio
15. Liquidity

Major differences in the individual quarter and combined quarterly analyses were: 1) factor 9 - Inventory Intensity appeared only in the third quarter, 2) factor 12 - Sales Velocity appeared in the first and third quarters only, and 3) three new factors appeared in the individual quarter results; these were Working Capital Intensity in the first, second and third quarters, Current Ratio in the second quarter, and Liquidity in the fourth quarter.

Table 4[a]
Combined and Individual Quarterly Factors

FACTOR Ratio	Combined Qrtly Loading	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Factor 1: Leverage		1	2	1	1
8 Total Liabilities/net worth	0.98	0.99	0.99	0.99	0.99
10 Total Assets/net worth	0.98	0.99	0.99	0.99	0.99
41 Sales/total capital	0.96	0.92	0.94	0.99	0.91
42 Current Assets/total capital	0.95	0.93	0.98	0.99	0.99
5 Current Liabilities/net worth	0.92	0.99	0.75*	0.93	0.93
7 Debt/total capital	0.57		0.86		0.85
40 Total Income/total capital	-0.50*	-0.95	-0.67*		
31 Net Income/net worth		-0.97			
Factor 2: Current Asset Turnover		2	3	2	2
21 Cash/Sales	0.95	0.97	0.97	0.98	0.97
24 Quick Assets/sales	0.95	0.97	0.98	0.97	0.97
22 Current Assets/sales	0.95	0.95	0.98	0.97	0.96
13 Cash/current liabilities	0.94	0.95	0.67*	0.95	0.96
19 Quick Assets/current liabilities	0.92	0.94	0.60*	0.93	0.95
32 Net Worth/sales	0.82	0.86	0.85	0.81	0.83
15 Current Assets/current liabilities	0.78	0.88		0.85	0.92
Factor 3: Return on Sales		7	1	6	4
1 Cashflow/sales	0.87	0.98	0.93	0.86	0.94
2 Total Income/sales	0.87	0.97	0.93	0.87	0.95
3 Net Income/sales	0.83	0.98	0.74*	0.87	0.92
29 Total Income/total assets	0.75	0.68*	0.84	0.61*	0.73*
9 Working Capital/total assets	0.74			0.78	
27 Cashflow/total assets	0.73	0.68*	0.84	0.59*	0.73*
44 Total Liabilities/total assets	-0.70		-0.50	-0.73	
37 EBIT/sales	0.76*	0.94	0.67*	0.75*	0.90
Factor 4: Return on Equity		3	5	3	3
39 Cashflow/total capital	0.95	0.96	0.97	0.93	0.99
28 Cashflow/net worth	0.94	0.78	0.97	0.93	0.99
40 Total Income/total capital	0.89		0.95	0.99	0.99
31 Net Income/net worth	0.65			0.98	0.98
5 Current Liabilities/net worth			-0.84		
7 Debt/total capital		0.92		-0.59	
Factor 5: Fixed Asset Turnover		11	7	8	5
14 Current Assets/total assets	0.85	0.55*	0.67*	0.59	0.70
18 Quick Assets/total assets	0.83		0.61*	0.56*	0.56*
38 Sales/net plant	0.74	0.80	0.86	0.88	0.83
4 Current Liabilities/net plant	0.65	0.93	0.76	0.88	0.83

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FACTOR Ratio		Combined Qrtly Loading	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Factor 6: Return on Assets			6	4	4	8
36	EBIT/total assets	0.94	0.96	0.91	0.96	0.96
30	Net Income/total assets	0.93	0.97	0.92	0.97	0.95
37	EBIT/sales	0.82	0.71*	0.77	0.85	0.73*
3	Net Income/sales	0.76*	0.65*	0.75	0.78*	0.68*
29	Total Income/total assets	0.70*	0.97		0.98	0.78
27	Cashflow/total assets	0.70*	0.96		0.97	0.78
31	Net Income/net worth			-0.77		
Factor 7: Inventory Turnover			8	8	7	7
11	Receivables/inventory	0.98	0.97	0.97	0.96	0.99
35	COGS/inventory	0.98	0.97	0.96	0.96	0.99
Factor 8: Working Capital Turnover			10	9	9	10
17	Inventory/working capital	0.95	0.94	0.95	0.94	0.95
33	Sales/working capital	0.95	0.94	0.95	0.94	0.95
Factor 9: Inventory Intensity					10	
16	Inventory/current assets	0.90			0.61	
23	Inventory/sales	0.77			0.85	
Factor 10: Debt Ratio			9	12	11	11
43	Debt/total assets	0.86	0.86	0.87	0.88	0.81
6	Debt/plant	0.82	0.87	0.80	0.81	0.89
Factor 11: Cash Turnover			4	6	5	12
26	Cash/fund expenditures	0.87	0.89	0.88	0.87	0.90
25	Quick Assets/fund expenditures	0.76	0.77	0.75	0.70	0.92
12	Cash/total assets	0.54	0.85	0.89	0.90	
18	Quick Assets/total assets		0.71	0.76	0.80	
16	Inventory/current assets		-0.70	-0.65	-0.56*	
Factor 12: Sales Velocity			12		12	
34	Sales/total assets	0.76	-0.68		0.88	
20	Receivables/sales	-0.73	0.72		-0.61	
23	Total Liabilities/total assets	-0.51*	0.81			
Factor 13: Working Capital Intensity			5	11		6
9	Working Capital/total assets		0.88	0.71		0.92
14	Current Assets/total assets		0.84	0.76		0.65*
23	Total Liabilities/total assets		-0.59*			-0.78
Factor 14: Current Ratio				10		
19	Quick Assets/current liabilities			0.97		
15	Current Assets/current liabilities			0.95		
13	Total Liabilities/total assets			0.95		
Factor 15: Liquidity						9
16	Inventory/current assets					0.90
12	Cash/total assets					-0.81
18	Quick Assets/total assets					-0.73

a   * indicates these ratios loaded higher on other factors.
    Blanks indicate that the ratios did not load greater than .49 on these factors.

To evaluate the potential variation in importance of the factors in the analyses presented above we compared the ordering of the factors in the combined and the individual quarter settings. The ranking of the factors is listed in Table 4 after the factor name. These ranks were established according to the percentage of variance explained in each of the analyses. Although some change in ranking would be expected due to random variation, substantially different ranks appeared in the individual quarters. Factors 3 - Return on Sales, 5 - Fixed Asset Turnover, and 11 - Cash Turnover show great variation in relative importance across periods.

An additional finding is that several of the ratios appeared to have low or unstable loadings from one quarter to the next. This is evidenced by the large number (38) of blank factor loadings in Table 4. These blanks indicate the ratios that had loadings of less than .5 on a factor in a given period. This finding indicates that several ratios are highly unstable from one quarter to the next.

In addition to the large number of ratios that are unstable, eight of the factors contain at least two ratios that remain quite stable in each of the four quarters. These factors are (1) Leverage, (2) Current Asset Turnover, (3) Return on Sales, (4) Return on Equity, (6) Return on Assets, (7) Inventory Turnover, (8) Working Capital Turnover, and (10) Debt Ratio. This finding indicates that if users of quarterly financial information are selective in their choice of key ratios, these ratios do in fact display the characteristics of stability found in previous annual studies.

To further compare the factors derived, Table 5 presents the number of ratios loading on each factor in the combined quarterly analysis with the individual quarterly analysis. Panels A through D present the

Table 5a
Comparison of the Number of Ratios Loading on Quarter 1 and Combined Quarterly Factors.[a]

Number of Ratios Quarter 1 Factor		Combined Quarterly Factor												
		1	2	3	4	5	6	7	8	9	10	11	12	Total
1	Leverage	5			2									7
2	Cur. Asset Turnover		7											7
3	Return on Sales			3		1								4
4	Return on Equity	1			2									3
5	Fix. Asset Turnover				2									2
6	Return on Assets			2		2								4
7	Inventory Turnover							2						2
8	W/Cap. Turnover								2					2
9	Inventory Intensity									0				0
10	Debt Ratio										2			2
11	Cash Turnover				2					1		2		5
12	Sales Velocity									1			2	3
	Other			1	1									2
	Total	6	7	6	4	5	3	2	2	2	2	2	2	43

[a]   This table presents the number of ratios with Quarter 1 loadings $\geq$ .70. On diagonal numbers represent agreement in factor classification, whereas, off diagonal numbers represent difference in factor classification.

Table 5b
Comparison of the Number of Ratios Loading on Quarter 2 and Combined Quarterly Factors.[a]

Number of Ratios Quarter 2 Factor		Combined Quarterly Factor												
		1	2	3	4	5	6	7	8	9	10	11	12	Total
1	Leverage	5												5
2	Cur. Asset Turnover		4											4
3	Return on Sales			3		1								4
4	Return on Equity	1			3									4
5	Fix. Asset Turnover					2								2
6	Return on Assets			1	1		3							5
7	Inventory Turnover							2						2
8	W/Cap. Turnover								2					2
9	Inventory Intensity									0				0
10	Debt Ratio										2			2
11	Cash Turnover					2						2		4
12	Sales Velocity												0	0
	Other		3			2								5
	Total	6	7	4	4	6	4	2	2	0	2	2	0	39

[a]   This table presents the number of ratios with Quarter 2 loadings $\geq$ .70. On diagonal numbers represent agreement in factor classification, whereas, off diagonal numbers represent difference in factor classification.

correspondence matrix for each of the four quarters, respectively. These tables indicate the number of ratios that loaded on a quarter's factors with loadings greater than .7 and which factors those same ratios loaded on in the combined quarterly analysis.

The correspondence is reflected in the number of ratios on the diagonal. Variation is indicated by the number of ratios off the diagonal. For the four quarters, there were 162 ratios that had at least a .7 loading. Of these, 7.4% of the ratios did not load on one of the twelve factors in the combined quarterly analysis and are classified in the "other" row of the tables. The second and fourth quarters each had five ratios which did not load on factors in the combined quarterly analysis, while the first and third quarters had two and zero ratios, respectively, that did not load on a combined quarterly factor. Numbers off the diagonal that are not in the "other" row represent ratios that loaded on different

factors in the individual versus combined quarterly analyses. Of the 23 ratios in this category 10 are confined to the first quarter (see panel A). The switching of ratios can provide information that helps identify the severity of the variations between individual and combined quarterly analyses. Panel A compares the first quarter to the combined quarterly results presented earlier.

A summary of this panel follows:

Two of the ratios that loaded on the Leverage factor in the first quarter, appeared in the Return on Equity factor in the combined analysis. These were total income/total capital and net income/net worth.

First quarter factor Return on Sales contained one ratio that loaded on the combined Return on Assets factor - debit/sales. Quarter one factor 4 - Return on Equity

Table 5c
Comparison of the Number of Ratios Loading on Quarter 3 and Combined Quarterly Factors[a].

Number of Ratios Quarter 3 Factor		Combined Quarterly Factor												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Leverage	5												5
2	Cur. Asset Turnover		7											7
3	Return on Sales			5										5
4	Return on Equity				4									4
5	Fix. Asset Turnover					2								2
6	Return on Assets			2			3							5
7	Inventory Turnover							2						2
8	W/Cap. Turnover								2					2
9	Inventory Intensity									1				1
10	Debt Ratio										2			2
11	Cash Turnover					2						2		4
12	Sales Velocity												1	1
	Other													0
	Total	5	7	7	4	4	3	2	2	1	2	2	1	40

[a] This table presents the number of ratios with Quarter 3 loadings $\geq$ .70. On diagonal numbers represent agreement in factor classification, whereas, off diagonal numbers represent difference in factor classification.

included debt/total capital which appeared in the combined factor Leverage.

Two ratios in quarter one factor Return on Assets - total income/total assets and cashflow/total assets loaded on the combined factor Return on Sales.

Quarter one factor Cash Turnover includes two ratios that were included in the combined factor Fixed Asset Turnover - cash/total assets and quick assets/total assets - and one ratio from the combined Inventory Intensity factor - inventory/current assets.

Sales Velocity in the first quarter includes inventory/sales, a ratio that loaded on Inventory Intensity in the combined analysis.

Variations in the remaining quarters are represented by the off diagonal elements in Panels B, C, and D.

Harmon (1976, p. 344) presents a statistical measure of factor stability called the congruency coefficient. These coefficients are interpreted similar to correlation coefficients and were used by Gombola and Ketz, 1981 as a measure of factor stability related to financial ratios. Table 6 presents congruency coefficients that were calculated to determine factor stability for all combinations of the quarterly and annual analyses.

Congruency coefficients greater than .95 indicate considerable agreement between factors. In the comparison between the combined quarterly and the annual factors significant variations are evidenced in factor nine with a congruency coefficient of .77. In comparing the individual quarters with the combined quarterly factors, variation is particularly evident in factors five, six, nine and twelve. In summarizing Table 6 there are 28 out of 132 comparisons (21%) that have congruency coefficients less than .9. This finding provides evidence that

Table 5d
Comparison of the Number of Ratios Loading on Quarter 4 and Combined Quarterly Factors[a].

	Number of Ratios Quarter 4 Factor	Combined Quarterly Factor												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Leverage	6												6
2	Cur. Asset Turnover		7											7
3	Return on Sales			3			1							4
4	Return on Equity				4									4
5	Fix. Asset Turnover					2								2
6	Return on Assets			2			2							4
7	Inventory Turnover							2						2
8	W/Cap. Turnover								2					2
9	Inventory Intensity									0				0
10	Debt Ratio										2			2
11	Cash Turnover											2		2
12	Sales Velocity												0	0
	Other			2		2				1				5
	Total	6	7	7	4	4	3	2	2	1	2	2	0	40

[a]   This table presents the number of ratios with Quarter 4 loadings $\geq$ .70. On diagonal numbers represent agreement in factor classification, whereas, off diagonal numbers represent difference in factor classification.

considerable factor variation exists.

VI. Discussion And Conclusions

The findings of this study indicate that fluctuations exist in the stability of factors underlying quarterly financial ratio information and that there is some potentially significant difference between annual and quarterly financial statement information. A second finding of this study is that annual financial statement ratios may reflect more than seven underlying dimensions when negative financial ratios are considered. Both of these issues have potential impact on decision making and present opportunities for further decision making research.

The first consideration for decision makers is that quarterly financial data appears to consist of underlying dimensions that are somewhat inconsistent than those derived from annual data. This finding indicates that decision makers relying on financial data may be well advised to be cautious in their use of key ratios for assessing a given aspect of a firms performance from quarterly data and comparing that with performance derived from annual data. An example of this finding is that the annual financial information appears to consist of two unique dimensions expressed by the annual Capital Ratio factor and the annual Leverage factor that are explained by the quarterly Leverage factor.

A second consideration that is more pervasive is that quarterly data lacks stability from one quarter to the next. This instability was evidenced in three ways. First, 20 percent of the individual quarterly ratios loaded on different factors than in the combined quarterly analysis.

Second, four quarterly factors Fixed Asset Turnover (5), Working Capital Turnover (6), Inventory Intensity (9), and Sales Velocity were highly unstable across quarters. Finally, three of the four most explanatory factors (Leverage, Return on Sales, and Return on Equity) consisted of several ratios that appear to be unstable from one quarter to the next.

Despite the apparent overall instability of quarterly data there does appear to be some indication of stability in the quarterly factor results. Many of the highest loading ratios are stable, with high loadings in each of the four quarters. For example, the Leverage factor consists of four ratios (total liabilities/net worth, total assets/net worth, sales/total capital, and sales/total capital) with high factor loadings consistently in each of the four quarters. Similar results hold for seven of the remaining 14 factors. These results indicate that there do exist several dimensions of quarterly financial information that can be reliably represented by key financial ratios. This finding indicates that if users of quarterly

Table 6
Congruency Coefficients

		One	Two	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Eleven	Twelve
Combined Quarterly with	Annual	0.84	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.77	0.99	0.94	0.98
	QTR 1	0.97	0.99	0.96	0.72	0.91	0.98	0.99	0.99	0.75	0.99	0.95	0.97
	QTR 2	0.99	0.97	0.98	0.91	0.94	0.83	0.99	0.99	0.75	0.99	0.94	0.65
	QTR 3	0.99	0.99	0.99	0.97	0.94	0.99	0.99	0.99	0.91	0.99	0.94	0.98
	QTR 4	0.97	0.99	0.95	0.99	0.94	0.99	0.99	0.99	0.75	0.99	0.97	0.65
Quarter 1 With	QTR 2	0.94	0.96	0.96	0.68	0.96	0.74	0.99	0.99	0.99	0.99	1.00	0.53
	QTR 3	0.94	0.99	0.96	0.74	0.99	0.99	0.99	0.99	0.49	0.99	0.99	0.91
	QTR 4	0.87	0.99	0.99	0.69	0.98	0.99	0.99	0.99	0.99	0.99	0.84	0.53
Quarter 2 with	QTR 3	0.99	0.96	0.97	0.85	0.99	0.81	0.99	0.99	0.99	0.99	0.83	1.00
	QTR 4	0.96	0.96	0.96	0.81	0.98	0.81	0.99	0.99	0.49	0.99	1.00	0.79
Quarter 3 with	QTR 4	0.96	0.99	0.95	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.82	0.79

FACTORS

financial information are selective in their choice of key ratios, these ratios do in fact display the characteristics of stability found in previous annual studies.

VII. Suggestions For Future Research

This study has shown that the information in quarterly financial statements varies from that presented in annual financial statements. Potential reasons for this finding include: the lack of a fully developed concept for interim reporting in the financial accounting standards, incentives to manage the numbers, and differential investment in quarterly and annual reporting systems. Future research should focus on discerning which of these potential causes is most critical.

A second finding of this study is that financial statements contain more underlying dimensions than previously reported. Future research should attempt to determine if there has been any effect on decision models that have retained too narrow a focus in using financial variables limited to those underlying dimensions previously reported.

✸✸✸Endnotes✸✸✸

1. Results of these studies are available from the authors upon request.
2. PEMC and PMC state that they analyzed 48 ratios but the reported results include only 44 ratios.
3. A rotation method that results in independent factors (such as varimax) is commonly used in a setting where the resulting factor scores will be used in subsequent analyses, where that independence has some attractive statistical properties. In a setting such as this one, however, where the objective of the analysis is the to examine the resulting factors as groups of related financial statement ratios, the use of an oblique rotation is warranted. For more on this discussion, see KDJ [13], pp. 32, 41-48. Results using varimax rotation (available from the authors) display similar characteristics to the results presented here but the variations are more difficult to interpret. In a setting where the dimensions of financial ratios are the subject of study, the use of a empirical algorithm that forces independence of factors on the data, would result in less, not more interpretable results.

4. Ratios 20 and 25 were retained in the analysis despite the low commonalities in order to retain comparability with prior studies.
5. The factor names were chosen after examining the ratios which loaded on each factor. While factor naming is subjective, the chosen names facilitate comparisons across analyses with no affect on the underlying results.

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APPENDIX 1

Ratio Number	Ratio	Ratio Definitions Using COMPUSTAT Data Item Numbers	
		Annual	Quarterly
1	Cashflow/sales	(18+14)/12	(8+5)/2
2	Total Income/sales	18/12	8/2
3	Net Income/sales	53(54)/12	(11*15)/2
4	Current Liabilities/net plant	5/8	49/42
5	Current Liabilities/net worth	5/[6-(5+9)]	49/60
6	Debt/plant	9/8	51/42
7	Debt/total capital	9/(37-9)	51/(62-51)
8	Total Liabilities/net worth	(5+9)/[6-(5+9)]	(44-60)/60
9	Working Capital/total assets	(4-5)/6	(40-49)/44
10	Total Assets/net worth	6/[6-(5+9)]	44/60
11	Receivables/inventory	2/3	37/38
12	Cash/total assets	1/6	36/44
13	Cash/current liabilities	1/5	36/49
14	Current assets/total assets	4/6	40/44
15	Current Assets/current liab.	4/5	40/49
16	Inventory/current assets	3/4	38/40
17	Inventory/working capital	3/(4-5)	38/(40-49)
18	Quick Assets/total assets	(1+2)/6	(36+37)/44
19	Quick Assets/current liabilities	(1+2)/5	(36+37)/49
20	Receivables/sales	2/12	37/2
21	Cash/sales	1/12	36/2
22	Current assets/sales	4/12	40/2
23	Inventory/sales	3/12	38/2
24	Quick Assets/sales	(1+2)/12	(36+37)/2
25	Quick Assets/fund expend.	(1+2)/[12-(41+13)]	(36+37)/[2-(30+21)]
26	Cash/fund expenditure	1/[12-(41+13)]	36/[2-(30+21)]
27	Cashflow/total assets	(18+14)/6	8+5/44
28	Cashflow/net worth	(18+14)/[6-(5+9)]	8+5/60
29	Total Income/total assets	18/6	8/44
30	Net Income/total assets	(53*54)/6	(11*15)/44
31	Net Income/net worth	(53*54)/[6-(5+9)]	(11*15)/60
32	Net Worth/sales	[6-(5+9)]/12	60/2
33	Sales/working capital	12/(4-5)	2/(40-49)
34	Sales/total assets	12/6	2/44
35	COGS/inventory	41/3	30/38
36	EBIT/total assets	[16+(53*54)+15]/6	[6+(11*15)+22]/44
37	EBIT/sales	[16+(53*54)+15]/12	[6+(11*15)+22]/2
38	Sales/net plant	12/8	2/42
39	cashflow/total capital	(18+14)/(37-9)	(8+5)/(62-51)
40	Tot Income/total capital	18/(37-9)	8/(62-51)
41	Sales/total capital	12/(37-9)	2/(62-51)
42	Current Assets/total capital	4/(37-9)	40/(62-51)
43	Debt/total assets	9/6	51/44
44	Total Liab./total assets	(5+9)/6	(44-60)/44

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