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From Ratios to Constructs: Sector-Contingent Financial Health Indices via Factor Analysis

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ABSTRACT

This paper investigates the reclassification of financial ratios through Exploratory Factor Analysis (EFA), trying to uncover empirical groupings that best describe the financial dynamics within the specific industry. We collected data of 19 commonly used financial ratios from 39 firms from two industries, including 22 from the FMCG and 17 from the Cement Sector, using 22 years from 2003 to 2024 through the audited annual accounts. The empirical findings reveal seven distinct categories within the FMCG sector and 6 within the Cement Sector, differing substantially from the traditional academic classification of 4 standard categories. These findings suggest that the behavior of financial ratios is sector-specific and classification in finance textbooks lacks empirical robustness if applied across different industry contexts. The empirical results also underscore the need for an industry-specific framework for financial analysis and raise critical implications for analysts, investors and educators to bridge the gap between the theoretical constructs and empirical financial analysis.

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1. Introduction

The stakeholders of a firm apply different methods and techniques to evaluate firm's financial performance. The literature has considered a variety of ways and sources to gather information about firms. On secondary data, various analytical techniques like Technical analysis, Trend analysis as well as analysis of fundamentals through ratios are applied to fulfill the needs of various stakeholders.

McCartney and Arnold (2012) discussed the evaluation of financial reporting, dividing it historically as "Commercial capitalism" (C1000AD to 1750) converted into the period of "Industrial capitalism" (C1751AD to 1830) and then shifted towards "Financial Capitalism" from 1830 onward. The Financial reporting went through an evolution based on the requirements in different phases. Today's Financial statements are divided into four major parts (Gitman, 2009) to fulfill the requirements of a variety of stakeholders. The performance of a firm is a concern for management. This performance is evaluated among the firms with the application of many analytical tools based on the requirements of various stakeholders. One of the powerful tools for analysis of financial statements is ratio analysis.

A variety of ratios are available but the importance of some ratios or a group of ratios is based on the nature of the relationship with the firm by the stakeholder. Hence the importance of different ratios varies from one stakeholder to another. The ratios of solvency are a leading concern for bankers while stockholders are concerned with the firm value and profitability, contrary to bankers and stockholders the management is interested in evaluating the overall situation of a firm (Brigham & Ehrhardt, 2005).

Horriang (1969) traced the origin of ratio analysis back to 300 B.C. Fowler (1980) concludes that the properties of ratio analysis were rigorously evaluated by Euclid which led to the foundation of financial statement analysis through ratio in the 19th century. At that time Managers in the United States focused on profitability as well as liquidity ratios. The current ratio which compares current assets against current liabilities was introduced in 1890.

The combination of different components of different financial statements is applied and evaluated in ratios. An example is activity ratios where heads of income statement along with the balance sheet are integrated to examine the efficiency of the operations of a business. The strengths and weaknesses of a firm can be evaluated and concluded through the relationship between the statement of financial position and the profit and loss account (Foster, 1978). Investment roots and operating efficiency of a business is studied through ratio analysis (Brigham and Houston, 2009).

Ratio analysis is frequently applied by investors to know about the worth of present investment and its future returns. Therefore, for evaluating a firm's historical performance as well as predicting its future financial performance, ratio analysis is a widely applied analytical tool.

1.1 Significance of Study

The contribution of this study to the literature is that it is an attempt to reduce the repetition of ratios through the application of statistical inference. Hence reducing the work to evaluate a firm's performance provided that similar characteristics are there in multiple ratios falling in the same category of ratios. This study explores new and minimum categories of ratios which can explain a firm's performance. Therefore, the primary objective of research is constructing the model based on the fruitfulness and usefulness among all the stakeholders which takes minimum effort and gathers all the

important information for related parties. Therefore, the study is fruitful for investors, and analysts with the least effort. Earlier studies are more focused and stick to academic classifications while this study approaches the classification of ratios from a professional perspective.

1.2 Underpinning and Supporting Theories

The classification of ratios among different categories remains a contentious issue among different scholars. The rationale behind this deviation is that a variety of approaches are available to select ratios fulfilling all needs of the stakeholders. The academic authors classify the ratios according to prevailing corporate practices and their personal views. The application of pragmatic empiricism is evident if we go through academic books. An instance is the book named "Financial Management and Policy" by Brigham and Ehrhart (2005) classify 15 ratios into four different categories of Profitability, liquidity, leverage and efficiency while market ratios are not a part of ratio analysis in this book.

Another approach to the classification of financial ratios is DuPont which was introduced by the DuPont Corporation in 1920. The distinguishing characteristic of this approach is the measurement of assets on gross book value to yield a higher return on equity.

Table 1. List of Financial Ratios with Academic Classifications

Ratios	**Labels**	**Ratios**	**Labels**
Liquidity Ratios		**Leverage Ratio**	
Current Ratio (CR)	**LIR1**	Debt to Assets (DTA)	LR1
Quick Ratio (QR)	**LIR2**	Debt to Equity (DTE)	LR2
Cash Ratio (CHR)	**LIR3**	Interest Coverage Ratio (ICR)	LR3
Profitability Ratio		**Activity Ratio**	
Gross Profit Margin (GPM)	**PR1**	Inventory Turnover (Times) (INVTOT)	**AR1**
Operating Profit Margin (OPM)	**PR2**	Inventory Turnover (Days) (INVTOD)	**AR2**
Net Profit Margin (NPM)	**PR3**	A/R Turnover (Times) (ARTOT)	**AR3**
Return on Equity (ROE)	**PR4**	A/R Turnover (Days) (ARTOD)	**AR4**
Return on Assets (ROA)	**PR5**	TA Turnover (TATO)	**AR5**
Earning Per Share (EPS)	**PR6**	FA Turnover (FATO)	**AR6**

The economic meltdown of 2008, while economies went through severe financial crises was a thought-provoking event and led many researchers to examine the financial performance of different sectors of the economy. The agribusiness was studied by Ketchowa and Enlow (2013) with a sample of all the firms in the time period of 1961 to 2011. The data for the studies included financial statements of the firms alongwith financial ratios. Du Pont technique was applied in order to split ROE into three parts. The findings conclude that market ratios, profitability and liquidity outplayed while comparing debt and liquidity ratios. The crux of the findings is that higher asset turnover leads to higher return on equity. The same approach was also applied in the study of Courtis (1978). His study contributed to developing a categorical framework for the classification of financial ratios normatively by recognizing and applying

linkages among different ratios and explaining the interrelation between ratios. As a result, the study maps a profile of corporate financial characteristics.

Different studies have applied different sets of financial ratios. sometimes abundance and replication of information remained problematic for the researchers as the information out of ratios applying the same data in different formulas. To overcome the problem of overlapping, the researchers apply various statistical techniques so that efforts can be minimized and the productivity of results can be maximized. The work of Pinches et al. (1973) applied factor analysis to classify financial ratios is considered a pioneer work. In this study, US industrial firms were sampled to classification of financial ratios. The time period of study was 1951 to 1969. The study concluded the categorization of financial ratios into seven different groups namely inventory intensiveness, receivable intensiveness, short-term liquidity, cash position, return on investment and capital intensiveness.

1.3 Problem Statement:

Although the traditional groupings of ratios like profitability, liquidity, leverage, and efficiency/activity implicitly assume that each metric has the same meaning across industries but financial ratios are the lingua franca of corporate analysis. The way a ratio co-moves with other ratios is altered by variations in capital intensity, inventory cycles, receivables policies, and pricing power; as a result, the "signal" of a ratio is not universal and is dependent on industry economics.

While studying a variety of financial ratios, we find repetition of numerous financial ratios with some differences in formatting. Reviewing the explicit theoretical structure of different ratios, Horrigan (1966) concluded the absence of explicit theoretical structure in the formation of different ratios which show the dominance of pragmatic empiricism. The following books are heavily influenced by pragmatic empiricism as reflected in the books of Khan and Jain (1981), Brigham and Ehrhardt (2005) and Brigham and Houston (2009)

All the authors, while classifying the ratios remained heavily influenced by past studies. On the other hand, researchers like Courtis (1978) and Laitinen (1983) applied DuPont method to classify the financial ratios. Deviating from pragmatic empiricism researchers such as Pinches et al. (1978), Gambola and Ketz (1983 and Salmi et al. (1990) applied factor analysis to conclude the categories of financial ratios. The problem arose while constructing groups through factors and placing ratios into groups. The findings of different researchers concluded different groups of ratios as well as differences in categorizing ratios into groups. The basic issue with the empirical-based classification is that it requires a thorough knowledge of ratios by the empirical researchers otherwise research results in ad hoc classification of groups.

There are big differences between Academic classification and professional classification and both have some shortfalls and constraints to solve the puzzle of efficient ratio analysis. Practically firms apply ratios which are feasible for their representations which are quite different than what is taught in the Academic books. The Academic books classify ratios into five different categories while empirical researchers and professionals in the firms introduced and inculcated many categories in the annual reports of firms. Some of the examples are the financial reports of Nestle, Unilever, Bestway Cement and D.G Khan Cement. Nestle has placed 48 ratios and grouped them into seven different categories, while Unilever placed 42 ratios and grouped them into six categories, Bestway Cement placed 34 ratios and grouped them into

six categories and D.G Khan placed 39 ratios into 7 different categories. The uniqueness of Nestle Pakistan's annual report are the supply chain metrics, Unilever's sustainability metrics, Bestway Cement's Environmental performance and D.G Khan's valuation ratios. This information was taken from the years of 2018- 2023 for Unilever and Nestle while 2023 for Bestway and 2021 for D G. Khan cement. These ratios are developed to cater the special needs of the mentioned companies hence these specialized ratios are not available in the Academic books.

Additionally, research by Iqbal et al., (2018) investigates the application of ratio analysis in specific sectors, such as banking. Similar studies can be conducted in industries like food industry and cement industry to identify industry-specific ratios for better financial performance evaluation.

Another problem is the overlapping of the ratios while applying numerous ratios. This study helps minimize the groups of categories. Table 1 presents the number of ratios studied in this paper. These ratios are studied in classrooms with the help of textbooks recommended for readings.

This paper addresses a practical research gap in two ways: first, by deriving validated, sector-specific latent constructs of financial health through contemporary factor-analytic methods; and second, by converting these constructs into uniformly designated composite indices that analysts can calculate and interpret within an industry context. By contrasting cement and FMCG—capital-intensive versus working-capital-intensive—we demonstrate that the latent structure of ratios is contingent upon industry, and that the resultant constructs effectively facilitate performance diagnosis, benchmarking, and risk assessment.

1.4 Purpose of the Study:

The primary objective of the study is to bridge the gap between the practical classification by firms and the academic classification of financial ratios. The foundation of academic categorization is expert opinion and past practice, while practicing firms have developed customized and unique categories based on the firms and industry. Unlike academic categorization, practicing professionals have developed many categories which are not part of current pedagogy. Although previous studies applied statistical inferences in this area to explore new categories to minimize the work to capture the performance of the firm.

1.5 Asymmetry and Signaling Theory

Ratios are signals taken from financial statements, and how useful they are depends on the situation and how easy they are to compare. The capital-market response to industry-specific standards suggests that identical accounting signals possess varying significance under industry-specific measurement rules, indicating that sector-specific latent constructs are the suitable unit of analysis. In this paper, factor-derived constructs serve as clearer, less noisy signals by aggregating co-moving ratios while considering industry context; this is the specific area where the credibility of signaling and the updating rules for receivers are significant (Fiechter et al., 2024).

2. Literature Review

Laniewar and Bansal (2021) conducted a comparative study of the oil and gas sector and pointed out that the importance of the ratios under study varies from industry to industry. The dilemma for decision makers is to understand the perspective of who is doing ratio analysis and the purpose of analysis. Without the understanding of the objectives of the researcher conducting the analysis, one might not be able to conclude the effectiveness of ratio analysis.

Hilkevics and Semakina (2019) consider the problematic issue with ratio analysis and its classification of usage by businesses without mentioning the objective of ratios and secondly who is performing the analysis and why. Amir and Ghitti (2020) applied financial ratios to predict the firm's financial performance from the perspective of investors to make well-informed investment decisions. The researchers raised an important issue that, unlike financial reporting, financial ratios are not regulated by governing bodies and therefore users are applying different operational definitions to financial ratios.

Dlotko et al. (2021) have studied the relationship of the seven most commonly used financial ratios and their relation with stock return. The study employed a conventional econometric and topological data analysis ball mapper (TDABM). The researcher suggested that the limitation to the model is the availability of ample data for the analyst.

Al-Kassar et al. (2019) conducted a study to evaluate the financial performance of Jordanian companies to predict financial failure. The study applied the data pertaining to financial ratios. It is a mixed research carrying the characteristics of both quantitative as well as qualitative as the researchers also interviewed higher management of Jordanian companies. The findings confirm that four ratios could elaborate the financial performance of the firm in the future. These ratios are current assets to total assets, debtors to sale ratio, NPBIT to current liabilities and market value of capital to book value of total debt. The model captured the predictive value to differentiate between successful and failed firms.

Restianti and Agustina (2018) studied the influence of financial ratios on financial distress. The study consists of 35 companies. The logistic regression was applied for statistical technique and findings confirm that EBIT to total assets and Return on Equity influence financial distress.

2.1 Re-classification of Financial Ratios

Financial ratio classification is an evolving field. Studies like "Financial Ratio Classification and Sub-sector Discrimination of Manufacturing Firms: Evidence from an Emerging Market" and "A Changed Taxonomy of Retail Financial Ratios" propose new classification frameworks tailored to specific industries (Chen et al., 2016; Luo et al., 2018).

Furthermore, research is exploring alternative ratio development techniques. "New Financial Ratios Based on the Compositional Data Methodology" examines this approach (Aitchison & Egozcue, 2005). The need for industry-specific frameworks is underscored by studies by " (Beaver, 1989; Palepu et al., 2010). These works highlight the importance of considering industry characteristics when selecting and interpreting financial ratios.

Gombola and Ketz (1983) explored cash flow ratios. The study applied factor analysis to the data of all the listed companies from 1962 to 1980 in the USA. The researchers applied forty financial ratios. The

study concluded with a load of cash flow to be categorized as a separate factor. The new factor was not captured by other ratio groups although it contains some important information about other ratios.

Principal Component Analysis was applied by Johnson (1978) to test the depth of the relationship in 61 financial ratios divided into two different groups of all the listed firms. The sample period was 1972 to 1974. The results suggested eight different classifications of ratios which are Receivable intensiveness, Capital intensiveness, Inventory Intensiveness, Cash Position, Return on investment, Financial leverage, Decomposition measures and short-term liquidity.

Chen and Shimerda (1981) studied previous studies on the ratios to find out commonalities between different researchers. They selected 26 different studies, selecting 65 financial ratios applied by different researchers and considered 41 ratios as useful. Theoretically, a researcher cannot remove ratios which might be useful for the nature of the topic. Therefore, the researchers have applied Principal Component Analysis to reduce the number of ratios repeating the same information again and again. The results conclude minimum number of ratios in even one ratio under one factor had a high correlation which distorts the results. The selected financial ratios contain similar information from their factor group at the same time distinctive information compared to other groups under study.

Beaver (1968) applied Discriminant Analysis for the classification of ratios. The methodological design of the study comprises two sets of sampled firms. One sample consisted of failed firms and another one was non-failed firms to conclude the predictive nature of ratios. The same methodological framework was applied by Altman (1968) with the application of the multivariate model for the classification of ratios.

To conclude the long-term credit standing, Horrigan (1966) conducted research for the selection of useful financial ratios. Six categories were established with seventeen ratios under the categories of liquidity and profitability. The study examined the correlation among the variables. Long-term solvency ratio, short-term capital turnover, total assets, profit margin and long-term capital turnover ratio had higher predictive significance.

From a different perspective, Kennedy (1955) performed a behavioral study to test the usefulness of four financial ratios. In designing the methodology, the researcher selected 24 loan officers belonging to different areas to participate in the study for testing the subjective probability of bankruptcy in firm's next year. The study applied Baye's Theorem with the information consisting of industry size, asset size, and four financial ratios. Sampling current, quick, debt and inventory turnover. The results suggest that non-ratio analysis is half as effective as financial ratios. The dependent variable in the study was the Likelihood ratio extracted from Baye's Theorem. The study concluded that the equity-to-debt ratio was the most meaningful financial ratio while applying Baye's theorem for evaluating bankrupt firms.

The problem of selective reporting of ratios by firms was addressed by Williamson (1984). On the methodological part, the researcher selected 141 firms from Fortune 500 companies to study the reported financial ratios by the management. With the application of a standardized computation method of ratios., eleven ratios were computed with the help of the Mann-Whitney U Test used for statistical inferences. The findings concluded that three financial ratios were more effective for reporting companies as compared to non-financial reporting. The dialectic findings of the study confirm that

Fortune 500 deliberately selected some ratios that are heavily dependent on the industry median rather than focused on the improvement of ratios.

Exploratory research was conducted by Kathleen et at. (2004) to evaluate the difference between fraudulent and non-fraudulent firms. 21 ratios were applied in discriminant ratios analysis. Only five were significant for the period. The change in the relationship of ratios was studied by Zeller et al. (2016) with the application of Principal Component Analysis. Fifty-eight ratios were identified alongwith four new factors alongside seven factors identified in the earlier studies.

Study by Thomas, John and Michail (2017), deals with the expanding requirement for a reorganized structure of retail industry financial ratios. Due to the rapid evolution of industry brought on by technological advancements, e-commerce, and distortion in customer behaviors, it suggests that traditional financial ratios used to evaluate retail performance may not adequately comply with the complexity of modern retail operations. A new taxonomy, or classification of financial ratios that includes more sector-specific metrics like digital sales, customer service and efficient inventory management is proposed for the study. Researchers recognize that these measures better capture the additional challenges retailers face in this new landscape where they must innovate to respond to a more digital marketplace and complexity and scale in the physical and online supply channels. In this context, reclassification is not merely the changing of existing ratios — though that's certainly part of it — but the development of new ratios that better reflect the shifting contours of the retailing business. This change enables analysts to assess the financial health of retail companies more precisely thereby providing them with more relevant data to make decision and strategy formulation in this extremely fast-changing marketplace.

Seref, Abdulmecit, Ali, and Ayhan (2005), take a different approach to reclassification, in focusing on manufacturing firms, and specifically in emerging markets. Among other points, the authors indicate that traditional financial ratios — those that are commonly applied across industries — do not consider the enormous distinctions among different forms of manufacturing business. The manufacturing business is an exciting and diverse people, ranging from heavy industries, light manufacturing, and many others, each requiring different metrics to judge performance appropriately. The study proposes reclassification of financial ratios across sub-sectors of the manufacturing industry. It does so in the expectation that if data are to be used to discriminate among firms operating in different parts of the manufacturing sector, such discrimination should be possible with greater ease and even intelligence in discriminating between the financial strengths and weaknesses of firms within these subsectors. Specifically in the realm of emerging markets, firms' financial profile — which can vary drastically depending on the economic conditions and market structures in that particular region — needs to be reclassified. It suggests that a more nuanced system of classification would facilitate more accurate financial analysis that will support the making and investing decisions for a sector as diversified as manufacturing, the study concludes.

The financial ratio reclassification literature reviews the development of methodologies seeking to enhance their analytical use and relevance. Challenges like redundancy, overlapping information, and varying applicability across industries have always been the issues that researchers have been focusing on resolving over time. At first, key financial metrics are broken down in early approaches, and later studies combine advanced statistical techniques to categorize and streamline ratios most efficiently. Sector-specific analyses have highlighted the requirement for more specialized classifications more

reflective of the specific features of an industry. Looking at this body of work as a whole, it is evident that economic agents have come to appreciate the need to improve financial ratios so that they better serve the task of evaluating performance and helping decision-makers in diverse economic settings.
By incorporating these advancements and tailoring ratio analysis to specific industries, stakeholders can gain deeper insights into a firm's financial health and make more informed decisions.

Based on the discussion in the introduction and literature review, we establish the following hypothesis.

H1: There is a gap between the practicing professional classification and the Academic classification of financial ratios.

3. Research Methods:

We have gathered the data of 39 non-financial firms, including 17 from the Cement and 22 from the FMCG sectors listed on PSX 100-Index, covering the period of 20 years from 2003 to 2024. On the methodological part, the audited financial statements are used to calculate the desired ratios. Based on the academic books, we have selected the 19 most frequent ratios. These ratios are categorized under the four broader academic classifications (Profitability Ratios, Liquidity Ratios, Activity Ratios, and Leverage Ratios).

On the other hand, firms practice these ratios with different categorizations. In this model, we apply classification as per academic pedagogy illustrated in the books by reputed authors. The data is related to only Pakistan but the results can be generalized to all the sectors of any emerging economy except the Services Sector.

The FMCG sector is of consumption and demand-side dynamics, cement indicates capital-intensive production and infrastructure supply-side forces. Together these two sectors give a balanced approach of both “demand for goods” and “industrial capacity.”

The FMCG sector is not only affecting growth in manufacturing, but also has spillover effects in other economic sectors like retail, packaging, advertising, media, and logistics. Cement is a backbone input for construction. The performance of sector is very much linked to infrastructure development, housing, public sector development programs (PSDP), and real estate. Studying both of the sector altogether helps generalize the empirical results to all sector of the economy.

3.1 Statistical Relationship among Ratios

Liquidity ratios represent the ability of a firm to meet its short-term obligations when they become due. It includes the current ratio and quick ratio mainly. This definition will change if this academic classification differs from the practical classification.

3.1.1 Liquidity Ratios

Current Ratio = Current Assets – Current Liabilities

This ratio assumes that current assets must be greater than current liabilities in order to meet the short-term obligations of the firm. It illustrates a firm’s ability to meet its short-term obligations with liquid assets like current assets.

Current Ratio = $\frac{Cash+Receivbales+Inventory+short-term\ Investments}{Payables-Accruals}$

Quick Ratio = Current Assets – Inventory

This ratio eliminates inventory from the current assets by assuming that this is not as liquid as the others in the current assets.

Quick Ratio = $\frac{Cash+Receivbales+short-term\ Investments}{Payables-Accruals}$

Cash Ratio

This explains a firm's ability to cover its short-term obligations with only cash, its most liquid current asset.

Cash Ratio = $\frac{Cash}{Current\ Liabilities}$

3.1.2 Profitability Ratios

Sequentially, the profitability ratios are calculated starting from GPM, OPM and finally NPM with the values of the audited income statement. Investors, practitioners and academic scholars also calculate ROE, ROA and EPS ratios for their analysis.

GPM = $\frac{Gross\ Profit}{Net\ Sales}$ OPM = $\frac{EBIT}{Net\ Sales}$ NPM = $\frac{Net\ Profit}{Net\ Sales}$

All of these ratios are scaled by the net sales to get the percentage of earnings at these three stages.

ROE = $\frac{Net\ Profit}{Common\ Equity}$ ROA = $\frac{Net\ Profit}{Total\ Assets}$ EPS = $\frac{Net\ Profit}{Shares\ Outstanding}$

These ratios are calculated for investors to get an idea of how much earnings they get on their equity investments. The definition and explanation will change if any of these ratios change their position from profitability to another category.

3.1.3 Leverage Ratios

This category of ratios suggests the firm to decide the combination of debt and equity in the capital structure. This mix of debt and equity helps firms to maximize shareholders' wealth, an ultimate objective of a corporation. Mainly following three ratios are calculated in this category.

DTA = $\frac{Total\ Debt}{Total\ Assets}$ DTE = $\frac{Total\ Debt}{Total\ Equity}$ ICR = $\frac{Interest\ Exp}{EBIT}$

3.1.4 Activity Ratios

This ratio category helps determine if the firm utilizes its assets efficiently in order to generate maximum output. The following ratios are calculated in this category.

Inventory Turnover in times = $\frac{Inventory}{COGS}$ Inventory Turnover in days = $\frac{365}{Inventory\ Turnover}$

Receivable Turnover = $\frac{Receivables}{Net\ Sales}$ Receivable Turnover in days = $\frac{365}{Receivable\ Turnover}$

Total Assets Turnover = $\frac{Net\ Sales}{Total\ Assets}$ Fixed Assets Turnover = $\frac{Net\ Sales}{Net\ Fixed\ Assets}$

3.2 Statistical Technique

For the formation of different categories, the study applied "Factor Analysis" since the loading of different factors guides us on which ratios are part of specific factors alongwith guiding us to name these categories.

4. Analysis and Results

The empirical conduit must be clear and able to be repeated. The sampling adequacy and sphericity validate factor analysis for both sectors, evidenced by KMO values exceeding 0.6 and p<0.001 in Bartlett tests (meeting conventional criteria), alongside eigenvalue and scree heuristics revealing 7 factors for Cement and 6 for FMCG. The best way to extract data is to use principal-axis factoring or minimum residuals with an oblique rotation (like oblimin or quartimin) because the constructs are expected to be related (Fabrigar, Wegener, MacCallum, & Strahan, 1999). The empirical results are placed below.

4.1 Descriptive Statistics

Table 2 shows the descriptive statistics of the Cement and FMCG sectors. It illustrates that the liquidity ratios LIR1, LIR2, and LIR3 of both sectors have positive mean values. It is also observed that the mean values of all these liquidity ratios are distinct from each other. The results indicate that LIR1 (current ratio) has the highest standard deviation in both sectors, showing higher movements in the current ratio.

The results also illustrate that the positive mean values of all the profitability ratios of both sectors. The mean values of positive profitability ratios indicate that the firms are producing sustainable profits from 2003 to 2024. The standard deviation results showed that PR6 (EPS) has the highest values and volatility.

Table 02: Descriptive Statistics – Cement and FMCG Sectors

Ratios Label	Cement Sector			FMCG Sector		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Liquidity Ratios						
LIR1	360	3.6499	21.3951	260	3.9401	18.3176
LIR2	360	3.0428	20.6436	260	2.6027	13.9092
LIR3	360	0.4298	1.4160	260	0.4331	1.0007
Profitability Ratios						
PR1	360	1.9648	12.5334	260	3.8040	10.0167
PR2	360	1.5853	7.1074	260	1.5846	5.1102
PR3	360	0.4105	12.3779	260	1.2825	4.1974
PR4	360	2.9059	14.0020	260	2.7222	21.1213
PR5	360	0.8359	3.4506	260	10.9164	42.2084
PR6	360	6.0606	14.2761	260	85.3023	780.7302

Activity Ratios						
AR1	360	25.0851	65.2514	260	81.9901	147.5078
AR2	360	3783.7862	11841.4271	260	70.0915	142.1857
AR3	360	54.9765	134.8120	260	12.0450	13.3999
AR4	360	15.3996	35.2956	240	86.8285	180.5843
AR5	360	5.4277	14.8825	260	1.7500	0.9196
AR6	360	6.1344	17.4431	260	3.2049	3.4031
Leverage Ratios						
LR1	360	1.6164	4.8660	260	2.0365	5.3213
LR2	360	3.4958	12.8564	260	1.1061	1.8394
LR3	360	1516.4915	28802.4450	260	89.7473	328.3677

The mean values of the activity ratios are also positive. Among the activity ratios, the highest mean value and standard deviations are of AR2 (Inventory Turnover Days) in the Cement Sector and AR4 (Account Receivable Turnover) in the FMCG Sector, indicating that the cement sector is more volatile with respect to inventory management, while the FMCG sector is more volatile with respect to receivable management.

Among the leverage ratios, the highest mean and standard deviation values in both sectors is LR3 (Interest Coverage Ratio), indicating that the profitability of firms in these sectors is much higher as compared to their interest expense.

4.2 KMO and Bartlett's Test

The results of KMO and Bartlett's Test of the Cement sector are presented in Table 3. KMO and Bartlett's Test is used to determine whether the data is suitable for factor analysis. The sampling adequacy is considered correct if the KMO value lies between 0.5 and 1. If the value is below 0.5, remedial action must be taken. Table 3 indicates that the KMO value of the cement sector is 0.655, which exceeds 0.5, making the data appropriate for factor analysis.

Table 03 : KMO and Bartlett's Test - Cement Sector

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.655
Bartlett's Test of Sphericity	Approx. Chi-Square	6114.759
	df	171
	Sig.	0.000

Table 4 represents the KMO and Bartlett's Test of FMCG sector. The KMO value is 0.674, which exceeds 0.5, making the data appropriate for factor analysis.

Table 04: KMO and Bartlett's Test – FMCG Sector

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.674

Bartlett's Test of Sphericity	Approx. Chi-Square	3183.153
	df	171
	Sig.	0.000

Table 5 presents the results of the total variance explained for the cement sector. We retained only the first seven factors because the eigenvalues are greater than one. According to the default mineigen (0) criterion, a factor must have an eigenvalue greater than zero to be retained. The analysis extracts 7 factors with eigenvalues greater than 1, explaining a significant percentage of variance.

Table 05: Total Variance Explained – Cement Sector

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.498	23.676	23.676	4.498	23.676	23.676
2	2.273	11.961	35.637	2.273	11.961	35.637
3	2.013	10.597	46.234	2.013	10.597	46.234
4	1.791	9.428	55.662	1.791	9.428	55.662
5	1.140	6.001	61.663	1.140	6.001	61.663
6	1.127	5.930	67.593	1.127	5.930	67.593
7	1.076	5.664	73.257	1.076	5.664	73.257

The scree plot is used to determine the number of factors to be retained. According to Cattell (1966), "A scree plot is a plot of the eigenvalues shown in decreasing order". Figure 1 below is the scree plot of the cement sector, showing that seven factors should be retained. Kaiser's well-known criterion suggests that we retain factors with eigenvalue larger than 1. Therefore, we have retained seven factors.

Figure 1: Scree plot – Cement Sector

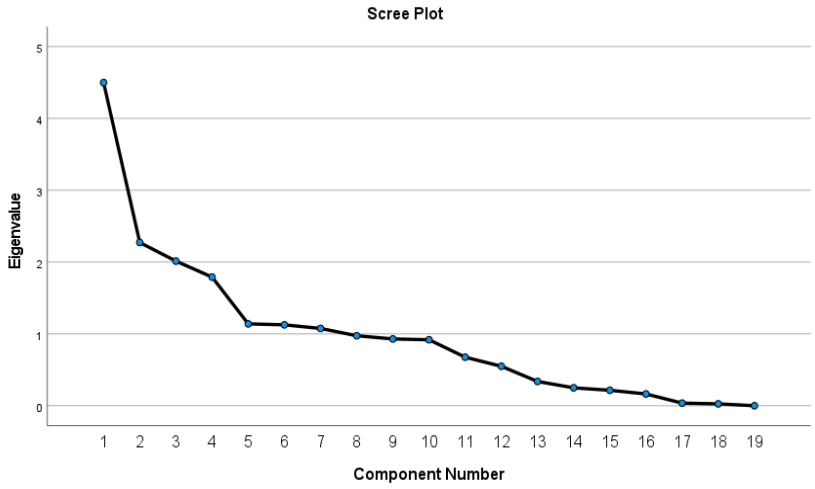

Table 6 presents the results of the total variance explained for the FMCG sector. We retained only the first six factors because the eigenvalues are greater than one. The analysis extracts 6 factors with eigenvalues greater than 1, explaining a significant percentage of variance.

Table 06: Total Variance Explained - FMCG Sector

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.112	21.641	21.641	4.112	21.641	21.641
2	2.542	13.381	36.022	2.542	13.381	36.022
3	1.869	9.838	44.860	1.869	9.838	44.860
4	1.442	7.589	52.448	1.442	7.589	52.448
5	1.269	6.681	59.130	1.269	6.681	59.130
6	1.038	5.465	64.595	1.038	5.465	64.595

Figure 2 below is the scree plot of the FMCG sector showing that six factors should be retained. Kaiser's well-known criterion suggests that we retain factors with eigenvalue larger than 1.

Figure 2: Scree plot – FMCG Sector

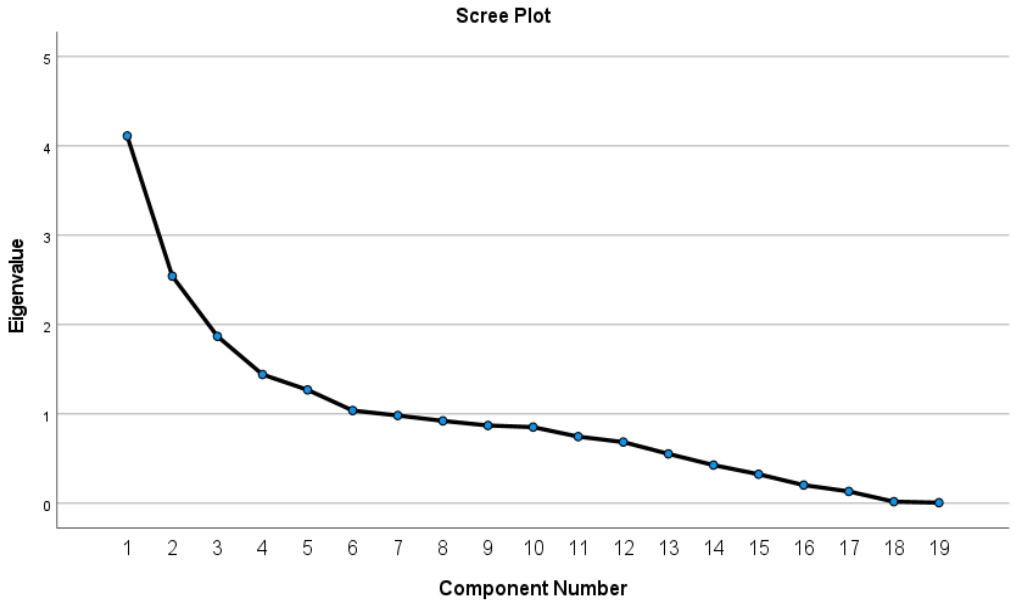

Table 7 represents the results of the Rotated Component Matrix of the cement sector. The Rotated Component Matrix is a key analysis tool that explains the rotated factor loadings. The results display the components with factor loadings greater than 0.5, removing any loadings below this threshold.

Table 07: Rotated Component Matrix- Cement Sector

Category	Ratios	Component						
		1	2	3	4	5	6	7
PR	ROA	0.866						

PR	ROE	0.911						
LR	DTA	0.748						
AR	TATO		0.872					
AR	FATO	0.563	0.781					
AR	ARTOT		0.702					
LR	DTE		0.672					
PR	GPM			0.914				
PR	NPM			0.944				
PR	OPM	0.745						
LIR	CR				0.998			
LIR	QR				0.998			
PR	EPS					0.920		
AR	INVTOT					0.909		
LR	ICR						0.651	
AR	ARTOD						0.767	
LIR	CHR							-0.502
AR	INVTOD							0.802

Factor 1

It includes ROA, ROE, DTA, FATO and OPM. All the factor loadings in Component 1 are significant. Although the loading of FATO is greater than 0.50, it also falls in the second component with a higher loading. Therefore, we remove FATO from the first factor. The first factor includes three Profitability Ratios (ROA, ROE and OPM) and one Leverage Ratios (DTA).

$$\text{Factor 1} = \frac{Net\ Profit}{Total\ Assets}, \frac{Net\ Profit}{Common\ Equity}, \frac{Total\ Debt}{Total\ Assets}, \frac{EBIT}{Net\ Sales}$$

The combination of Leverage and Profitability Ratios in factor 1 makes it a new classification with a new definition. It is also evident that this factor does not match the academic classification of ratios. It is a challenge for academicians and practitioners to name this classification with a proper definition.

Factor 2

It includes TATO, FATO, ARTOT and DTE with significant factor loadings. This factor incorporates three Activity ratios (TATO, FATO and ARTOT) and one from the Leverage ratios (DTE).

$$\text{Factor 2} = \frac{Net\ Sales}{Total\ Assets}, \frac{Net\ Sales}{Net\ Fixed\ Assets}, \frac{Receivables}{Net\ Sales}, \frac{Total\ Debt}{Total\ Equity}$$

Grouping of activity and leverage ratios in factor 2 creates a new classification which does not match with the existing academic classifications.

Factor 3

It includes GPM and NPM with significant factor loadings. Both of the factors come from Profitability ratios.

Factor 3 = $\frac{Gross\ Profit}{Net\ Sales}$, $\frac{Net\ Profit}{Net\ Sales}$

Factor 3 includes two ratios which belongs to profitability ratios, hence does not require the establishment of any new classification.

Factor 4

It includes CR and QR with significant factor loadings. Both of the variables come from Liquidity ratios.

Factor 4 = $\frac{Cash+Receivbales+Inventory+short-term\ Investments}{Payables-Accruals}$, $\frac{Cash+Receivbales+short-term\ Investments}{Payables-Accruals}$

Factor 4 includes two ratios which belongs to liquidity ratios, hence does not require the establishment of any new classification.

Factor 5

It includes EPS and INVTOT with loadings greater than 0.5 and significant. EPS comes from Profitability ratios while INVTOT comes from Activity ratios.

Factor 5 = $\frac{Net\ Profit}{Shares\ Outstanding}$, $\frac{Inventory}{COGS}$

Factor 5 includes EPS from the profitability ratios and Inventory turnover in times from activity ratios. Since both of the ratios belong to two different classifications, a new classification is required.

Factor 6

It is comprised of ICR and ARTOD with significant factor loadings. The ICR comes from Leverage ratios and AARTOD comes from Activity ratios.

Factor 6 = $\frac{Interest\ Exp}{EBIT}$, $\frac{365}{Receivable\ Turnover}$

Factor 6 incorporates Interest Coverage ratio from leverage and receivable turnover in days from activity category, requiring a new classification with the new definition.

Factor 7

It incorporates CHR and INVTOD with significant factor loading. The CHR comes from Liquidity ratios and INVTOD comes from Activity ratios.

Factor 7 = $\frac{Cash+Receivbales+short-term\ Investments}{Payables-Accruals}$, $\frac{365}{Inventory\ Turnover}$

Factor 7 incorporates cash ratio from the liquidity and inventory turnover in days from activity category, requiring a new classification with the new definition.

Although the combination of these categories of ratios makes it difficult to interpret, it is evident that the existing academic classification does not match with the practical classification of ratios at least in the Cement Sector of Pakistan.

Table 08: Rotated Component Matrix- FMCG Sector

Category	Ratios	Component					
		1	2	3	4	5	6
PR	GPM	0.900					
PR	NPM	0.948					
PR	OPM	0.957					
PR	ROA	0.420					
PR	ROE	0.793					
AR	ARTOT	0.690					
LR	DTA		0.747				
AR	TATO		0.760				
AR	FATO		0.884				
LIR	CR			0.985			
LIR	QR			0.987			
LR	ICR				0.634		
AR	INVTOT				0.743		
AR	INVTOD				-0.553		
LR	DTE					0.515	
AR	ARTOD					0.702	
LIR	CHR						0.594
PR	EPS						0.259

Table 8 represents the results of Rotated Component Matrix of FMCG. The results display the components with factor loadings greater than 0.5, removing any loadings below this threshold.

Factor 1

It includes GPM, NPM, OPM, ROA, ROE and ARTOT with factor loadings except ROA which has a loading of less than the threshold value of 0.50. therefore, we remove ROA from the factor 1. All the variables come from the Profitability ratios except the ARTOT which comes from the Activity ratios.

Factor 1 $\frac{Gross\ Profit}{Net\ Sales}$, $\frac{Net\ Profit}{Net\ Sales}$, $\frac{EBIT}{Net\ Sales}$, $\frac{Net\ Profit}{Total\ Assets}$, $\frac{Net\ Profit}{Common\ Equity}$, $\frac{365}{Receivable\ Turnover}$

Factor 2

It includes DTA, TATO and FATO with significant factor loadings. DTA comes from the Leverage ratios while TATO and FATO come from the Activity ratios.

Factor 2 $\frac{Total\ Debt}{Total\ Assets}$, $\frac{Net\ Sales}{Total\ Assets}$, $\frac{Net\ Sales}{Net\ Fixed\ Assets}$

Factor 3

It incorporates CR and QR with significant factor loadings. Both of the variables come from the Liquidity ratios.

Factor 3 $\frac{Cash+Receivbales+Inventory+short-term\ Investments}{Payables-Accruals}$, $\frac{Cash+Receivbales+short-term\ Investments}{Payables-Accruals}$

Factor 4

It includes ICR, INVTOT and INVTOD with factor loadings. The ICR comes from the Leverage ratios while rest of the two variables come from the Activity ratios.

Factor 4 $\frac{Interest\ Exp}{EBIT}, \frac{Inventory}{COGS}, \frac{365}{Inventory\ Turnover}$

Factor 5

It includes DTE and ARTOD with significant factor loadings. The DTE belongs to the Leverage ratios while the ARTOD comes from the Activity ratios.

Factor 5 $\frac{Total\ Debt}{Total\ Equity}, \frac{365}{Receivable\ Turnover}$

Factor 6

It includes CHR, and EPS with significant factor loadings. The CHR belongs to the Liquidity ratios while the EPS comes from the Profitability ratios.

Factor 6 $\frac{Cash+Receivbales+short-term\ Investments}{Payables-Accruals}, \frac{Net\ Profit}{Shares\ Outstanding}$

4.3 In-Depth Analysis

Table 9 shows the rows for each cement-sector category and the different ratios that can be used. For Category 1 (ROA, ROE, DTA, FATO, OPM), use "Leverage-Amplified Profit Engine" to show that profitability is driven by margins and improved by the structure and use of the balance sheet. To show throughput under debt for Category 2 (TATO, FATO, ARTOT, DTE), use "Gearing-Driven Asset Velocity." For Category 3 (GPM, NPM), use "Margin Cascade Efficiency" to tell the difference between before and after overhead capture. Use "Immediate Liquidity Cushion" for Category 4 (CR, QR). For Category 5 (EPS, INVTOT), use "Earnings–Inventory Velocity" to show how profit per share is related to stock turns. Use "Coverage–Collection Timing" for Category 6 (ICR, ARTOD). Use "Cash Buffer–Stock Holding" for Category 7 (CHR, INVTOD). These names show the joint economic mechanism that the co-loadings in the rotated matrix suggest, and they match up perfectly with the ratio combinations that are already in the table.

Table 9: Cement Sector - Reclassification of Ratios

Category	**Ratios**	Category Label
Category 1	ROA, ROE, DTA, FATO and OPM	Leverage-Amplified Profit Engine
Category 2	TATO, FATO, ARTOT and DTE	Gearing-Driven Asset Velocity
Category 3	GPM and NPM	Margin Cascade Efficiency
Category 4	CR and QR	Immediate Liquidity Cushion
Category 5	EPS and INVTOT	Earnings–Inventory Velocity
Category 6	ICR and ARTOD	Coverage Collection Timing
Category 7	CHR and INVTOD	Cash Buffer–Stock Holding

Table 10 shows six categories for FMCG, each with the same ratio clusters that the rotated matrix narrative has already found. The new labels should once again show the combination semantics instead of the general taxonomies. Use "Profitability–Sales Flow Synergy" for Category 1 (GPM, NPM, OPM, ROE, ARTOT). "Debt-Backed Asset Productivity" is the name for Category 2 (DTA, TATO, FATO). Use "Operating Liquidity Reserve" for Category 3 (CR, QR). "Coverage–Inventory Cycle" is the term for Category 4 (ICR, INVTOT, INVTOD). Use "Gearing–Receivables Drag" for Category 5 (DTE, ARTOD). Use "Cash–Earnings Signal" for Category 6 (CHR, EPS). Each term purposefully links the financial and operational levers suggested by the cluster, and they can all be used exactly as they are in the "Category Label" column to meet the reviewer's request for six different labels.

Table 10: FMCG Sector - Reclassification of Ratios

Category	Ratios	Category Label
Category 1	GPM, NPM, OPM, ROA, ROE and ARTOT	**Profitability Sales Flow Synergy**
Category 2	DTA, TATO and FATO	**Debt Backed Asset Productivity**
Category 3	CR and QR	**Operating Liquidity Reserve**
Category 4	ICR, INVTOT and INVTOD	**Coverage Inventory Cycle**
Category 5	DTE and ARTOD	**Gearing Receivables Drag**
Category 6	CHR, and EPS	**Cash Earnings Signal**

These newly labeled categories provide a structured way to evaluate a firm's performance effectively over multiple years.

4.4 Suggested Definitions of each categories - Cement Sector

4.4.1 Leverage-Amplified Profit Engine

It demonstrates how operating margin and ROA/ROE scale when a business is heavily indebted. It demonstrates whether leverage is effectively increasing operating performance (and asset utilization) into shareholder returns or if it is just a means of increasing financial risk with no guarantee of return.

4.4.2 Gearing-Driven Asset Velocity

It relates capital structure to the rate at which assets and receivables are turned into sales (total/fixed asset and A/R turnover). It determines whether greater leverage causes friction that slows working-capital movement or is linked to tighter, faster asset cycling.

4.4.3 Margin Cascade Efficiency

it monitors the "drop-through" between net and gross margins. It shows how well revenue is converted into bottom-line profitability as well as discipline across the cost stack (COGS, operating costs, finance charges, and taxes).

4.4.4 Immediate Liquidity Cushion

It uses current and quick assets (without inventories) to calculate the short-term buffer needed to meet obligations. It displays the ability to absorb shocks in regular operations without the need for outside.

4.4.5 Earnings–Inventory Velocity

It relates the speed at which inventory cycles to earnings per share. It determines whether earnings are susceptible to inventory slowdowns or whether faster inventory turns are translating into sustainable earnings power.

4.4.6 Coverage Collection Timing

It combines receivables collection days with interest-coverage strength. It emphasizes how, even in cases where accounting profits appear sufficient, slower customer payments can reduce the amount of money available for debt service.

4.4.7 Cash Buffer–Stock Holding

It weighs days of inventory on hand against pure cash liquidity. It shows if the company has enough cash on hand right now compared to the amount of inventory it needs to maintain supplies for its customers and plants.

4.5 Suggested Definitions of each categories - FMCG Sector

4.5.1 Profitability Sales Flow Synergy

It combines the rate of sales collections (A/R turnover) with margins and returns. It demonstrates whether high sales-to-cash pipeline throughput is enhancing profitability or concealing margin fragility.

4.5.2 Debt-Backed Asset Productivity

It evaluates whether assets that actually work harder—higher total/fixed asset turnover—are being financed by leverage (debt to assets). When additional borrowing is unable to increase real operating intensity, it raises a red flag.

4.5.3 Operating Liquidity Reserve

It uses quick and current ratios to highlight core working-capital headroom. It shows how well the company can withstand seasonality, promotions, and demand shocks without experiencing liquidity issues.

4.5.4 Coverage Inventory Cycle

It combines inventory speed (turns and days) with interest-coverage resilience. It shows how the cash capacity to service financing costs is impacted by stock movement, whether it is rapid or slow.

4.5.5 Gearing Receivables Drag

It shows financial "drag" by combining receivables days with equity gearing, or debt-to-equity. Refinancing risk and working-capital strain are increased by higher leverage and slower collections.

4.5.6 Cash Earnings Signal

It evaluates the quality of earnings by combining the cash ratio and EPS. Durable performance is indicated by strong EPS backed by instant cash liquidity; a gap indicates cash conversion vulnerability.

5. Conclusion

The analysis shows that there are latent constructs of financial health that depend on the sector. For example, cement's structure is based on capital intensity, coverage, and inventory holding, while FMCG's

structure is based on margin architecture, receivables discipline, and cash-conversion speed. The paper converts these constructs into named composite indices that professionals can calculate using public accounts, making it possible to use factor results in decision-making.

Co-loadings like leverage with asset velocity or margins with receivables turnover show that the financial "health" of a business is determined by the economics of capacity utilization, channel execution, and working-capital policy working together. These results show why universal ratio taxonomies don't work and why any composite metric of performance needs to include the context of the industry.

This research indicates that the relationships between profitability and liquidity, as well as liquidity's influence on capital structure and performance, exhibit instability across various regimes and contexts, aligning with our observation that factor compositions vary among sectors. Consequently, our constructs correspond with the empirical literature's shift from universal relationships among ratios.

Emerging markets represent a significant area of focus. Empirical research on ratio behavior in non-OECD contexts suggests that traditional taxonomies do not adequately reflect the specific dynamics of sectors and countries. Additionally, Restianti and Agustina (2018) and Al-Kassar et al. (2019) reported that the predictive value of ratios for financial distress and failure in Indonesia and Jordan is significantly influenced by sector structure and institutional context.

Lanjewar and Bansal (2021) found that ratio-based classification and clustering of Indian industrial and oil-and-gas firms should be customized to reflect industry characteristics instead of being directly adopted from generic frameworks. The studies, along with banking-sector evidence from Iqbal et al. (2018), highlight the necessity for nuanced ratio classifications tailored to emerging markets.

All the results confirm the previous empirical findings which suggests that existing categorization of ratios do not match with the professional classifications which are used by corporations. There are limited number of studies which took this concept into a research. This is the reason to incorporate limited number of papers in the current study. Besides, the study also confirm the existing practices by corporations to use their own ratio classification as can be seen in their audited annual accounts.

6. Contributions to knowledge.

The paper adds news knowledge in the existing body of the literature in the following manners.

i. delineates industry-specific ratio structures,
ii. presents a clear labeling framework that correlates statistical variables with economically interpretable composite names,
iii. suggests Composite Industry Factor Scores as practitioner-ready indices, and
iv. corroborates constructs against value-based outcomes as an external validation of economic significance.

7. Limitations.

Loadings can be affected by how sensitive they are to the composition of the sample and the classification of the sector. Ratio sets share accounting bases that may cause residual dependence even after pre-processing. The number of factors that are kept can change depending on the method used to keep them, which is why parallel/MAP triangulation is recommended. A compositional approach lessens these problems, but it doesn't get rid of them completely.

8. Future research.

By looking at more sectors, testing scalar invariance across macro regimes, comparing classical and compositional FA head-to-head, and linking factor scores to cost-of-capital or spread outcomes, we could learn more about how sector economics affect ratio constructs.

9. Policy Recommendations

- In order to avoid confusing terminology and concepts, regulators should establish ratio disclosure templates that are relevant to each industry.
- It would be beneficial for businesses to use standardized composite indicators so that their reports are based on reliable financial metrics.
- Thresholds for leverage, liquidity, and productivity should be established by supervisors in monitoring frameworks based on sectors.
- Factor scores can be used in rating and credit systems to improve covenant design and early warning models.

10. Practical Implications

- Managers can enhance decision-making and monitor performance more effectively through sector-specific composite indexes.
- To more accurately reflect actual economic indicators such as capital intensity and liquidity cycles, scorecards and dashboards may be revised utilizing these frameworks.
- By employing factor-based indices that reduce duplication, creditors and analysts can improve credit assessments and valuation models.
- Emerging markets frequently present inconsistent data and limited historical records; however, sector-specific models can provide valuable assistance in addressing these challenges.

References

Al-Kassar, T., et, al (2019). “The use of Accounting and Financial ratios to predict failure: The case of Jordon”. Academy of Accounting and Financial Studies Journal, 23(3), 1-21.

Altman Edward I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. The Journal of Finance, Vol. 23, No. 4. pp. 589-609.

Amir, E., & Ghitti, M. (2021). Financial Analysis of Business Combinations (Advanced Issues). In Financial Analysis of Mergers and Acquisitions: Understanding Financial Statements and Accounting Rules with Case Studies (pp. 165-190).

Beaver, W. H. (1968). Alternative accounting measures as predictors of failure. The Accounting Review, 43(1), 113–122.

Brealey, R. A., Myers, S. C., & Marcus, A. J. (2001). Fundamentals of corporate finance. McGraw-Hill.

Brigham, E. F., & Ehrhardt, M. C. (2005). Financial management (11th ed.). South-Western College Publishing.

Brigham, E. F., & Houston, J. F. (2009). Fundamentals of financial management. Cengage Learning.

Cattell, R. B. (1966). The scree test for the number of factors. Multivariate Behavioral Research, 1(2), 245–276.

Chen, K. H., & Shimerda, T. (1981). An empirical analysis of useful accounting ratios. Financial Management, 10(1), 51–60.

Courtis, J. K. (1978). Modelling a financial ratios categorical framework. Journal of Business Finance & Accounting, 5(4), 371–386.

Dłotko, P., Qiu, W., & Rudkin, S. T. (2021). Financial ratios and stock returns reappraised through a topological data analysis lens. The European Journal of Finance, 1–25.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. Psychological Methods, 4(3), 272–299.

Fiechter, P., Landsman, W. R., Peasnell, K., & Renders, A. (2024). Do industry-specific accounting standards matter for capital allocation decisions? Journal of Accounting and Economics, 77(2–3),

Foster, G. (1978). Financial statement analysis. Prentice-Hall.

Fowler, D. H. (1980). Book II of Euclid's Elements and a pre-Eudoxan theory of ratio. Archive for History of Exact Sciences, 22(1–2), 5–36.

Gitman, L. J. (2009). Principles of managerial finance. Pearson Prentice Hall.

Gombola, M. J., & Ketz, J. E. (1983). A note on cash flow and classification patterns of financial ratios. The Accounting Review, 58(1), 105–114.

Hilkevics, S., & Semakina, V. (2019). The classification and comparison of business ratios analysis methods. Insights into Regional Development, 1(1), 47–56.

Horrigan, J. O. (1966). The determination of long-term credit standing with financial ratios. Journal of Accounting Research, 4, 44–62.

Johnson, W. B. (1978). The cross-sectional stability of financial patterns. Journal of Business Finance & Accounting, 5(2), 207–214.

Katchova, A. L., & Enlow, S. J. (2013). Financial performance of publicly traded agribusinesses. Agricultural Finance Review, 73(1), 58–73.

Kaminski, K. A., Wetzel, T. S., & Guan, L. (2004). Can financial ratios detect fraudulent financial reporting? Managerial Auditing Journal, 19(1), 15–28.

Kennedy, H. A. (1975). A behavioral study of the usefulness of four financial ratios. Journal of Accounting Research, 13(1), 97–116.

Khan, M. Y., & Jain, P. K. (1981). Cost accounting. McGraw-Hill.

Laitinen, E. K. (1983). A multivariate model of the financial relationships in the firm. The Finnish Journal of Business Economics, 32(4), 317–333.

Lanjewar, A. A., & Bansal, R. (2021). A comparative analysis of the financial ratios of oil and gas companies. IUP Journal of Accounting Research & Audit Practices, 20(2), 27–44.

McCartney, S., & Arnold, A. J. (2012). Financial capitalism, incorporation and the emergence of financial reporting information. Accounting, Auditing & Accountability Journal.

Pinches, G. E., Mingo, K. A., & Caruthers, J. K. (1973). The stability of financial patterns in industrial organization. The Journal of Finance, 28(2), 389–396.

Restianti, T., & Agustina, L. (2018). The effect of financial ratios on financial distress conditions in sub industrial sector company. Accounting Analysis Journal, 7(1), 25–33.

Salmi, T., Virtanen, I., & Yli-Olli, P. (1990). On the classification of financial ratios: A factor and transformation analysis of accrual, cash flow and market-based ratios (Acta Wasaensia No. 25). University of Vaasa.

Zeller, T. L., Kostolansky, J., & Bozoudis, M. (2016). Have changes in business practices and reporting standards changed the taxonomy of financial ratios? American Journal of Business, 31(2), 85–97.

Williamson, R. W. (1984). Evidence on the selective reporting of financial ratios. The Accounting Review, 59(2), 296–299.