# Title: Exploring Financial Ratios in the Consumer Staples Industry: A Comprehensive PCA Analysis (2005-2022)

Abstract

***Purpose*** *- The consumer goods industry in the United States have long grown to be conglomerates and have reached maturity stage. It becomes instrumental to analyze the financial performance of these companies to set them apart. Unfortunately, it becomes cumbersome to comprehend different financial ratios and deduce the number of ratios needed with little information loss.*

***Data and Methodology*** *- From the financial statements of the seven conglomerates, a total of 15 ratios have been calculated for a period of 18 years. To find variables with significant value of more than 0.5, principal component analysis was performed for each component.*

***Findings*** *- We conclude that instead of the time and resource consuming analysis of unneeded ratios, one can analyze these companies only using 8 ratios, which become easier to interpret. One can use only a handful of components with manageable loss of information owing to most ratios being related.*

## Introduction

The financial performance of a company holds paramount significance for both new and prospective investors. Key stakeholders and shareholders alike closely monitor a company's financial health, prompting the utilization of various tools for fundamental analysis. Among these tools, financial ratios stand out as crucial instruments, offering a systematic approach to interpret financial statements, facilitate comparisons, and conduct trend analyses. This comprehensive assessment plays a pivotal role in evaluating different facets of a company's operations. While there is a plethora of financial ratios available for analysis, time constraints necessitate a focus on a select few. Public data libraries provide a myriad of ratios for individual companies but analyzing them all can be time-consuming and may not always yield the most accurate insights. Therefore, it becomes imperative to streamline the analysis by reducing the number of ratios, striking a balance between efficiency and data loss. To address this challenge, we employ Principal Component Analysis (PCA) to distill the 15 initial variables into 9, focusing on the 8 most pertinent ratios. This streamlined approach enables a comprehensive assessment of key investment parameters for prominent companies in the consumer staples industry—Unilever, PepsiCo, Procter & Gamble, Coca-Cola, General Mills, Mondelez, and Nestle. Principal Component Analysis serves as a form of multidimensional scaling, effecting a linear transformation of variables into a lower-dimensional space while retaining maximum information about these variables. By reducing the number of variables, we not only simplify the analysis but also enhance its precision and cost-effectiveness. This study underscores that a thorough analysis of a company can be conducted with a select few ratios, offering a more efficient and accurate means of evaluation while minimizing data redundancy.

Main Implications in the finance industry and for Investors -

Risk Management- By reducing the dimensions of data, it helps in understanding the correlated risks more effectively. This is crucial for risk assessment and portfolio management in the financial industry.

Portfolio Diversification- PCA helps in identifying uncorrelated financial ratios which would help investors diversify their portfolios since low correlations lead to higher diversification. It can also help in identifying hidden relations between different ratios which could help in leverage-based strategies.

Modelling and Forecasting- PCA helps in building highly complex and efficient financial models by reducing the multicollinearity amongst different financial ratios.

Feature Selection- Various financial institutions build credit scoring models or risk assessment frameworks. PCA can help in identifying the most important variables required for analysis. This simplifies the model while retaining critical information.

Detecting Financial Anomalies- PCA can assist in detecting anomalies or irregular patterns in financial data by highlighting deviations from expected ratios or behavior, aiding in fraud detection and risk mitigation.

**Industry**

The US consumer staples industry has a rich history dating back to the country's early years. In the late 19th and early 20th centuries, the Industrial Revolution spurred the growth of this sector, with companies focusing on producing essential goods such as food, beverages, tobacco, household products, and personal care items. Brands like Procter & Gamble, Coca-Cola, Kellogg's, and Colgate emerged during this period, establishing themselves as household names through innovative marketing, product development, and widespread distribution networks. The Great Depression further solidified the industry's importance as consumer demand remained relatively stable for these essential items, emphasizing their non-cyclical nature.

Throughout the decades, the consumer staples industry witnessed significant changes driven by technological advancements, shifting consumer preferences, and regulatory developments. Post-World War II, the industry experienced substantial growth and consolidation, with companies diversifying their product offerings and expanding globally. The latter half of the 20th century saw an increased emphasis on healthier products, sustainability, and convenience, prompting companies within this sector to adapt their portfolios and manufacturing processes to meet evolving consumer demands. The industry's resilience during economic downturns and its continuous innovation have contributed to its enduring significance within the US economy.

The consumer staples sector is a collective grouping of industries that cater to essential everyday needs, irrespective of economic conditions or individual financial circumstances. Stocks within this sector often contribute to portfolio stability and long-term growth. Given the nature of staple products, the central concern is not whether the product is in demand, but rather if consumers will choose a particular company's product over competitors. Due to the plethora of options in these product categories, establishing a sustainable competitive advantage is challenging. Companies are fighting to either become the low-cost leader or differentiate their products sufficiently to justify premium pricing. Brand recognition plays a pivotal role in this sector, prompting many companies to allocate substantial budgets to marketing and branding efforts. Unlike other industries, macroeconomic drivers have minimal impact on the consumer staples sector. Changes in interest rates, unemployment, or consumer spending typically exert little influence on these industries. The primary driver in this sector is consumer preferences. As staples are universally consumed, the choice of which company to patronize ultimately hinges on personal preference. This dynamic foster intense competition among companies producing similar products.

**Unilever PLC**

A multinational consumer goods company founded in 1930, is a global leader in the production of food, beverages, cleaning agents, and personal care products. With an extensive portfolio that includes renowned brands such as Dove, Lipton, Ben & Jerry's, and Axe, Unilever operates in over 190 countries, catering to diverse consumer needs. The company places a strong emphasis on sustainability, aiming to reduce its environmental impact and improve societal well-being through its Sustainable Living Plan. Unilever's commitment to innovation, ethical business practices, and social responsibility has positioned it as a prominent player in

the consumer goods industry, striving to create a positive impact while meeting consumer demands worldwide.

**Pepsi Co.**

PepsiCo, established in 1965 through the merger of Pepsi-Cola and Frito-Lay, is a global powerhouse in the food and beverage industry. Renowned for iconic brands like Pepsi, Lay's, Gatorade, Quaker Oats, and Tropicana, PepsiCo operates across more than 200 countries, offering a diverse range of snacks, beverages, and food products. The company's success stems from continuous innovation, strategic acquisitions, and a strong focus on meeting changing consumer preferences, including healthier options and sustainability initiatives. The company's stock is listed on NASDAQ stock exchange and has historically been considered a stable investment option in the consumer goods sector.

**Procter & Gamble**

Procter & Gamble (P&G) is a multinational consumer goods corporation renowned for its extensive portfolio of household, personal care, and hygiene brands. With a history dating back to the 19th century, P&G's products include familiar names like Pampers, Tide, Gillette, and Crest, catering to diverse global markets. P&G boasts consistent financial performance, with substantial annual revenues and strong profitability. Its strategic focus on cost-efficiency, research, and development initiatives has led to sustained growth and competitive advantages within the consumer goods industry. The company's global presence, extensive distribution networks, and efficient supply chain management contribute significantly to its revenue streams and market leadership.

**Coca-Cola**

Coca-Cola, an iconic global beverage company founded in 1886, boasts an extensive portfolio of soft drinks and non-carbonated beverages like Coca-Cola, Diet Coke, Sprite, and Dasani water. With unparalleled brand recognition and a presence in over 200 countries, Coca-Cola's qualitative strength lies in its robust marketing strategies, ingrained cultural significance, and consumer loyalty across diverse demographics. Quantitatively, Coca-Cola has historically exhibited strong financial performance, characterized by substantial revenues and consistent profitability. Leveraging its efficient bottling and distribution networks, the company continuously adapts to changing market demands, innovates new products, and maintains a competitive edge in the beverage industry.

**General Mills**

General Mills, founded in 1866 and listed on the New York Stock Exchange (NYSE) under the ticker symbol "GIS," is a multinational food company headquartered in the United States. The company specializes in producing and marketing branded consumer foods, including ready-to-eat cereals, refrigerated yogurt, snacks, baking mixes, and pet foods. General Mills operates an extensive portfolio of well-known brands such as Cheerios, Betty Crocker, Yoplait, Haagen-Dazs, and Nature Valley, catering to consumers globally. General Mills, like other major food companies, has historically experienced revenue fluctuations influenced by changing consumer preferences, market conditions, and economic factors.

**Mondelez International, Inc.**

Mondelez International, Inc. is a multinational snack food and beverage company headquartered in Deerfield, Illinois, United States. The company was established in 2012 following a split from Kraft Foods, and it operates in over 150 countries worldwide. Mondelez has a rich history in the consumer goods industry, tracing its roots back to renowned brands like Nabisco, Cadbury, and Milka. It became a separate publicly traded company in 2012 after the split from Kraft Foods. Mondelez holds a significant market share in the global snacking industry, competing with other major players like Mars, Nestlé, and Hershey's. Its strong presence in numerous markets has helped it maintain a competitive edge. Mondelez has demonstrated consistent growth through strategic acquisitions, innovation in product development, and expansion into emerging markets.

**Nestle S.A.**

Nestlé S.A. is a Swiss multinational food and beverage processing conglomerate headquartered in Vevey, Vaud, Switzerland. Since 2014, it has been the world's largest publicly traded food company in terms of revenue and other metrics. It was ranked No. 64 on the Fortune Global 500 in 2017 and No. 33 on the Forbes Global 2000 list of the world's largest public companies in 2016. Nestlé's products include baby food (some of which contain oligosaccharides derived from human milk), medical food, bottled water, breakfast cereals, coffee and tea, confectionery, dairy products, ice cream, frozen food, pet foods, and snacks. Nestlé has 29 brands with annual sales of more than 1 billion CHF (about US$1.1 billion), including Nespresso, Nescafé, and KitKat.

**Literature Review:**

To analyze companies using quantitative methods, three financial statements; balance sheet, income statement and cash flow statements are required. Since these statements are made adhering to accounting standards, the data can be extracted for reporting. This step is important as the company can evaluate its operational decisions throughout the period and analyze its SWOT metrices that require attention[i]. With that, "they also provide clues on where the management might find more resources to boost its revenue"[ii]. In 2023 outlook for the consumer products industry Deloitte[iii] mentions that the consumers' needs have changed drastically these past few years and also mentions companies venturing into the world of technology in the name of AI to plunge themselves into the growth category. These changes in companies would be reflected in their financial statements in terms of investments, capital expenditures, cash flows etc. Hence, a need arises to measure this ever-changing economic performance of the industry. The consumer goods industry is highly cash flow dependent and prone to supply chain changes which are reflected in their balance sheet and income statement. Their fiscal condition and "rank" in their industry could be derived by just looking at the ratios. Although it might be useful, it should be taken into account that these ratios are isolated from other factors in the report; so, precaution should be taken when deriving interpretation from them.[iv]

In recent times, more advanced statistical analysis tools have become prominent in the industry; leading to reduced time put into ratio analysis, we believe that they still hold great power when analysis companies in the same industry. If we try to look at some studies to prove the one study by Altman (1968)[v] jumped out to prove that ratios are still beneficial to predict bankruptcy when he used manufacturing firms as example. Another study by Chen and Shimerda maps out different ratios and where does their intuition come from. They analyzed hundreds of ratios and categorized them into seven factors. They found that empirical study is needed every time to analyze which ratios to use for investment research.

With that, we would mainly be looking into performance indicators as in the study by Allen et al. and another by Burja[vi] and another study by Yusheng and Mbona[vii] tries to analyze three giant conglomerates in Chinese Telecom industry and deduct the number of ratios needed using various reduction methods. The factors that are being used in ratio analysis are mostly within the control of the management and these are used to influence the decision internally. "The management can anticipate changes in the external environment and try to position the company to take advantage of anticipated developments" in the study by Burja. Factors outside the control of management, or so-called external factors include GDP, changes in demographics, CPI, inflation etc. If the qualitative factors are put aside, both internally and externally, management still must analyze many factors which are very subjective and outside the scope of this study.

Another similar study by Kofi-Akrofi[viii] was similar, but he had taken multiple regression to look at the Telecommunications industry in the region of Ghana regarding their profitability of four years. He tried to find relationships with two financial statements, and as a result, they were counted as independent.

Numerous case studies have been reviewed for ratios used in financial statements, but some knowledge gaps still exist. First, we were not able to detect any that so far have focused on the Consumer Goods sector in the USA after their sheer size. Second, only a handful of research studies have incorporated PCA to look for which ratios might be the best fit to analyze a company with the lowest amount of data loss among all the ratios. We realized the ratios which were incorporated and many of them would be correlated owing to their inclusion in the same financial statements when we reviewed the case studies. Similar study by Taylor[ix], focused more on the Australian firms. But the study did not focus on one or similar companies, hence we realized, with different industries there might not be a different one-size-fits-all model out there or can be created with PCA. Third, using PCA gives the opportunity to incorporate at least 15 ratios which reduces effects of subjectivity on which ratios may be used for further analysis one of which may include regression analysis on their performance. Last, our correlation matrix which we have displayed in the study, it becomes apparent that ratios are related meaning there is no chance of a regression due to correlation. This relationship can be explained by these ratios' existence in the same financial statements. By applying PCA, we can make fresh independent variables that allow for efficient and more effective further analysis with a lower number of variables.

**Objectives:**

1. Gather 15 financial ratios for the American Consumer Staples industry.
2. Carry out PCA on those ratios to reduce the number of variables and analyze the correlation between components.
3. To best analyze and assess the performance in the industry with recommendations of a combination or mix of ratios.
4. Examine the highest varying ratios and assess their gravity on the industry.

## Data and Methodology

Ratios Used:

| Ratio Class | Ratio | Formula |
|---|---|---|
| Profitability | Return on Equity (ROE) | Net Income / Shareholders Equity |
| | Net profit margin | Net Income / Revenue |
| | EBITDA Margin | EBITDA / Revenue |
| | Current Ratio | Current Assets / Current Liabilities |
| Liquidity | CFO/Average Current Liabilities | Cash Flow from Operations / Current Liabilities |
| | Times Interest Cover | EBIT / Interest Expense |
| | Inventory Turnover | COGS / Average Inventory |
| | Accounts Receivable Turnover | Net Credit Sales / Average Accounts Receivables |
| Working Capital | Working Capital Turnover | Revenue / Net Working Capital |
| Leverage Ratio | Debt Equity Ratio | Total Debt / Total Equity |
| Dupont Ratio | Assets Turnover | Revenue / Average Total Assets |
| Multiples Ratios | Free Cash Flow per Share | Free Cash Flow / Number of Shares Outstanding |
| | EPS | Retained Earnings / Number of Shares O/S |
| | EV/EBITDA | Enterprise Value / EBITDA |
| Dividend | Dividend Payout Ratio | Dividends / Net Income |

Mainly two models have been incorporated in various studies to establish the relationship between ratios and financial statements. One of the models is OLS regression. OLS has been applied by various accounting articles on financial performance and that only to a maximum of ten ratios (Al-Jafari and Al Samman, 2015; Jakob, 2017; Burja, 2011). Another model is multiple regression, on which many other researchers have worked; namely Kofi-Akrofi.

We use PCA, a statistical tool, to reduce the number of variables which would be used in analysis of data and that with minimum loss to the original data, which may be 85%-90% of the original data (Bro and Smilde, 2014)[x]. PCA is one of the most common methods used in a number of industries, one of the common being in Biomechanical. They use those methods in biometrics or bioimaging where in smartphones there are physical features of a person that are used for computer applications to identify the function. Many times, to reduce the dimensions of large volume of data to compress images have been done using PCA. (Arab 2018). Since this is a statistical tool, business field can also take use for it to reduce the technical jargon when analyzing companies. As noted in the literature review, PCA's application to reduce variables makes it a significant tool in the current era where we have large volumes of data than any point in the history. To talk about business field, in a study by Taylor to reduce the number of ratios which were used for analysis Australian companies since most, if not all, ratios are available, makes the PCA model extremely powerful in aiding investors. And for those who analyze ratios and claim to have knowledge of most important ratios, PCA offers a path to reduce the amount of ratios by statistically choosing those which have significant value and to also reduce biases. To reduce the number of complexities and use regression, PCA makes a fresh set of artificial variables which are not related, as in independent, from each other and

helps in conclusion of related variables. PCA, by itself, is limited to reducing the variables that are further used in regression analysis.

PCA, a statistical tool, is employed to effectively diminish the number of variables utilized in data analysis while retaining as much as 85% to 90% variance to the original dataset (Bro and Smilde, 2014). Widely embraced across various industries, including Biomechanics, PCA finds application in biometrics and bioimaging, where physical characteristics captured by smartphones aid in computer-driven identification processes. Additionally, PCA has been instrumental in compressing images by reducing the dimensions of extensive data sets (Arab, 2018). It is also used in the finance industry in risk management, portfolio optimization, asset pricing models, and financial forecasting. It aids in reducing dimensions and identifying critical factors in economic data analysis. PCA also finds its application in astronomy and astrophysics among various other industries. In astronomy and astrophysics, PCA helps in reducing noise and extracting meaningful features from massive datasets generated by telescopes and astronomical observations.

We start by understanding what PCA is. We found that the best explanation is always the simplest one. Principal component analysis (PCA) is a statistical procedure that transforms a set of possibly correlated variables into a smaller set of uncorrelated variables called principal components. These principal components are ordered by their decreasing variance, which indicates the amount of information they capture about the original data. We can gain intuition by doing cumulative addition of their variance and stopping at the point where most of the variation has been observed which is usually at 85% to 90%.

PCA is a complex technique, but it can be understood intuitively by thinking about the following analogy: Imagine that you have a set of data points that are scattered around in a two-dimensional space. You want to find the line that goes through the center of the data points and captures the most information about the data. This line is called the first principal component. You can then find the line that is perpendicular to the first principal component and that captures the next most amount of information about the data. This line is called the second principal component.

The first principal component is comprised of a combination of all X variables that explain the maximum variance. The first component is usually responsible for taking most of the variation in the data. When it comes to the second component it also takes up the maximum variation possible in the remaining data. One condition that it to be kept in mind here is that there is 0 correlation between the first and second component. This same process is repeated till the last component accounts for the remaining variation in the data. The 0-correlation condition remains for all components in question.

Eigenvectors are used in the principal component estimation as coefficients to calculate the following formulas –

$Y_1 = e^{\wedge}_{11}ZX_1 + e^{\wedge}_{12}ZX_2 + e^{\wedge}_{13}ZX_3 + \ldots + e^{\wedge}_{1i}ZX_i$; (1)

$Y_2 = e^{\wedge}_{21}ZX_1 + e^{\wedge}_{22}ZX_2 + e^{\wedge}_{23}ZX_3 + \ldots + e^{\wedge}_{2i}ZX_i$; (2)

$Y_i = e^{\wedge}_{i1}ZX_1 + e^{\wedge}_{i2}ZX_2 + e^{\wedge}_{i3}ZX_3 + \ldots + e^{\wedge}_{ii}ZX_i$ ; (3)

Where Y represents principal components; ê explains the eigenvector; and ZX is the standardized value of the ratios. We have standardized data in Microsoft Excel. Standardized data is a scaled version of the dataset that has a mathematical mean of 0 and a standard deviation amounting to 1.

The eigenvectors of the covariance matrix of the data points correspond to the directions of the principal components, and the eigenvalues of the covariance matrix correspond to the magnitudes of the variance in those directions. In other words, the eigenvectors tell us which directions are the most important for capturing the information in the data, and the eigenvalues tell us how much information is captured in each direction.

The standard PCA workflow in MATLAB that we used was that firstly we made sure that the rows were equal to the observations and columns were equal to the variables. Next, we standardized our data (Z scores).

"Latent", which is available in the output, shows the variance that is explained by each principal component; "explained", shows the percentage of the total variance that is explained by the principal component. Variance explained was used in deciding how many principal components to keep for the final analysis.

**Variables**

We have chosen a total of 15 accounting ratios that have been most prevalent in accounting literature and are deemed as one of the most important measures of management efficiency, liquidity, profitability, valuation, and cash flow indicators for the consumer staples companies. The mentioned components however are not exhaustive because PCA has the ability to cover more ratios, but they start to border the scope of the study. Some of the ratios are more relevant to the Consumer Goods industry and differ from those chosen in a different industry. The ratios that we have chosen that are extensively used to analyze the consumer staples industry are return on equity, net profit margin, EBITDA Margin, current ratio, CFO to Average Current Liability, Times Interest Coverage Ratio, Inventory Turnover Ratio, Accounts Receivable Turnover, working capital turnover, free cash flow per share, debt to equity ratio, assets turnover, EPS, EV to EBITDA and Dividend Payout Ratio.

**Data**

We have gathered data from the fiscal year 2005 to 2022. This is the period where most of the data was available for these companies and this data also incorporates two outliers: the Great Financial Crisis and Covid-19 pandemic. Microsoft Excel has been used for financial data and

their corresponding ratios after which MATLAB Software and its relative add-ons have been used to carry out PCA. A PCA would put more emphasis on the variables that would have higher variance as compared to those variables that would have low variance if we used raw data without standardizing.

The financial data that is taken is secondary. The data has been sourced from the **Bloomberg Terminal** because we believe the service, they provide is relatively the strongest and not skewed.

| Descriptive Statistics for Individual ratios | | | | | | |
|---|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | Standard Deviation | Variance |
| Return on Equity | 18 | 19.80 | 32.63 | 24.03 | 3.61 | 13.03 |
| Net profit margin | 18 | 10.77 | 16.06 | 12.77 | 1.49 | 2.23 |
| EBITDA Margin | 18 | 18.78 | 22.97 | 20.57 | 1.14 | 1.30 |
| Current Ratio | 18 | 0.73 | 1.08 | 0.90 | 0.09 | 0.01 |
| CFO/Average Current Liabilities | 18 | 0.36 | 0.53 | 0.44 | 0.05 | 0.00 |
| Times Interest Cover | 18 | 8.17 | 1593.46 | 98.60 | 373.07 | 139181.84 |
| Inventory Turnover | 18 | 5.96 | 6.99 | 6.42 | 0.29 | 0.08 |
| Accounts Receivable Turnover | 18 | 7.89 | 12.72 | 11.03 | 1.41 | 1.98 |
| Working Capital Turnover | 18 | -88.32 | 19.83 | -15.09 | 29.64 | 878.72 |
| Free Cash Flow per Share | 18 | 1.86 | 3.78 | 2.74 | 0.61 | 0.37 |
| Debt Equity Ratio | 18 | 52.10 | 175.23 | 101.76 | 38.90 | 1513.52 |
| Assets Turnover | 18 | 0.60 | 0.85 | 0.73 | 0.09 | 0.01 |
| EPS | 18 | 2.09 | 6.19 | 3.15 | 1.16 | 1.34 |
| EV/EBITDA | 18 | 10.12 | 20.08 | 14.48 | 3.07 | 9.43 |
| Dividend Payout Ratio | 18 | 39.39 | 135.82 | 64.31 | 20.96 | 439.17 |

Correlation Matrix:

| DP | EV/EBITD | EPS | FCF/S | AT | D/E | WCT | ART | IT | IC | CFO/L | CR | EBITDA/ | NPM | ROE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -0.41 | -0.01 | 0.24 | 0.08 | 0.32 | 0.13 | -0.08 | -0.06 | -0.24 | 0.11 | 0.09 | -0.03 | 0.59 | 0.79 | 1.00 | ROE |
| -0.45 | -0.04 | 0.40 | -0.23 | 0.08 | 0.19 | -0.13 | -0.01 | -0.16 | 0.09 | 0.07 | -0.10 | 0.70 | 1.00 | 0.79 | NPM |
| -0.39 | -0.19 | 0.20 | -0.12 | 0.00 | 0.08 | -0.11 | 0.06 | -0.16 | 0.13 | 0.13 | -0.06 | 1.00 | 0.70 | 0.59 | EBITDA/R |
| -0.08 | -0.32 | -0.16 | 0.27 | -0.16 | -0.14 | 0.11 | -0.08 | -0.01 | 0.10 | 0.30 | 1.00 | -0.06 | -0.10 | -0.03 | CR |
| -0.10 | -0.13 | -0.13 | 0.32 | -0.45 | 0.22 | 0.09 | 0.11 | 0.10 | 0.19 | 1.00 | 0.30 | 0.13 | 0.07 | 0.09 | CFO/L |
| -0.19 | -0.24 | 0.02 | 0.41 | -0.27 | -0.23 | 0.07 | -0.15 | 0.14 | 1.00 | 0.19 | 0.10 | 0.13 | 0.09 | 0.11 | IC |
| 0.19 | 0.05 | 0.11 | 0.02 | -0.03 | 0.27 | 0.08 | 0.30 | 1.00 | 0.14 | 0.10 | -0.01 | -0.16 | -0.16 | -0.24 | IT |
| 0.03 | 0.19 | 0.03 | -0.08 | 0.04 | 0.27 | -0.02 | 1.00 | 0.30 | -0.15 | 0.11 | -0.08 | 0.06 | -0.01 | -0.06 | ART |
| 0.01 | -0.09 | -0.14 | 0.17 | -0.09 | -0.01 | 1.00 | -0.02 | 0.08 | 0.07 | 0.09 | 0.11 | -0.11 | -0.13 | -0.08 | WCT |
| 0.22 | 0.43 | 0.25 | -0.53 | 0.38 | 1.00 | -0.01 | 0.27 | 0.27 | -0.23 | 0.22 | -0.14 | 0.08 | 0.19 | 0.13 | D/E |
| 0.32 | 0.48 | 0.20 | -0.36 | 1.00 | 0.38 | -0.09 | 0.04 | -0.03 | -0.27 | -0.45 | -0.16 | 0.00 | 0.08 | 0.32 | AT |
| -0.31 | -0.52 | -0.20 | 1.00 | -0.36 | -0.53 | 0.17 | -0.08 | 0.02 | 0.41 | 0.32 | 0.27 | -0.12 | -0.23 | 0.08 | FCF/S |
| -0.09 | 0.10 | 1.00 | -0.20 | 0.20 | 0.25 | -0.14 | 0.03 | 0.11 | 0.02 | -0.13 | -0.16 | 0.20 | 0.40 | 0.24 | EPS |
| 0.57 | 1.00 | 0.10 | -0.52 | 0.48 | 0.43 | -0.09 | 0.19 | 0.05 | -0.24 | -0.13 | -0.32 | -0.19 | -0.04 | -0.01 | EV/EBIT |
| 1.00 | 0.57 | -0.09 | -0.31 | 0.32 | 0.22 | 0.01 | 0.03 | 0.19 | -0.19 | -0.10 | -0.08 | -0.39 | -0.45 | -0.41 | DP |

**Results and Discussion:**

**Explained Variance:**

| Components | Latent | Variance | Cumulative |
|---|---|---|---|
| 1 | 3.06 | 21.41 | 21.41 |
| 2 | 2.85 | 19.98 | 41.38 |
| 3 | 1.59 | 11.17 | 52.55 |
| 4 | 1.08 | 7.56 | 60.11 |
| 5 | 1.00 | 7.03 | 67.14 |
| 6 | 0.88 | 6.15 | 73.29 |
| 7 | 0.81 | 5.68 | 78.97 |
| 8 | 0.79 | 5.53 | 84.50 |
| 9 | 0.60 | 4.19 | 88.69 |
| 10 | 0.52 | 3.63 | 92.31 |
| 11 | 0.40 | 2.80 | 95.11 |
| 12 | 0.36 | 2.51 | 97.62 |
| 13 | 0.19 | 1.34 | 98.96 |
| 14 | 0.10 | 0.69 | 99.66 |
| 15 | 0.05 | 0.34 | 100.00 |

**Coefficients:**

| | PC1 | PC2 | PC3 | PC4 | PC5 | PC6 | PC7 | PC8 | PC9 |
|---|---|---|---|---|---|---|---|---|---|
| **ROE** | 0.14 | 0.00 | 0.43 | 0.10 | -0.41 | 0.34 | 0.19 | **0.47** | 0.04 |
| **NPM** | -0.43 | -0.11 | 0.05 | 0.10 | 0.21 | 0.03 | 0.14 | 0.39 | 0.42 |
| **EBITDA/R** | -0.21 | 0.02 | **0.53** | -0.37 | -0.03 | -0.31 | -0.22 | -0.02 | 0.32 |
| **CR** | -0.24 | -0.09 | 0.13 | -0.44 | 0.16 | -0.16 | **0.65** | -0.16 | -0.28 |
| **CFO/L** | 0.38 | 0.12 | -0.17 | -0.09 | 0.38 | 0.11 | 0.35 | 0.31 | -0.03 |
| **IC** | 0.33 | -0.30 | 0.03 | -0.10 | 0.24 | -0.26 | -0.11 | 0.06 | -0.13 |
| **IT** | -0.08 | 0.46 | 0.07 | -0.06 | -0.13 | 0.04 | -0.14 | 0.02 | -0.41 |
| **ART** | 0.15 | 0.27 | 0.07 | 0.44 | 0.15 | -0.09 | 0.28 | -0.44 | **0.48** |
| **WCT** | **0.44** | -0.04 | 0.05 | -0.10 | 0.15 | -0.17 | -0.25 | 0.24 | 0.14 |
| **FCF/S** | 0.35 | 0.13 | 0.42 | -0.19 | 0.07 | -0.04 | -0.02 | -0.21 | 0.05 |
| **D/E** | 0.08 | -0.14 | 0.50 | **0.45** | 0.12 | 0.05 | 0.19 | -0.04 | -0.32 |
| **AT** | -0.01 | **0.54** | 0.05 | -0.02 | 0.00 | 0.00 | -0.08 | -0.08 | -0.10 |
| **EPS** | -0.04 | 0.50 | -0.02 | -0.16 | 0.26 | 0.04 | 0.07 | 0.30 | 0.12 |
| **EV/EBITDA** | -0.28 | 0.05 | 0.14 | 0.37 | 0.44 | -0.31 | -0.25 | 0.20 | -0.28 |
| **DP** | -0.10 | -0.12 | 0.15 | -0.18 | **0.46** | **0.74** | -0.27 | -0.25 | 0.02 |

We used PCA to narrow down key insights and reduce dimensionality in our comprehensive study spanning 15 distinct financial ratios over an 18-year period for seven industry-leading consumer staples companies. The cumulative variance explained by the first nine PCs reached 88.69%, providing an overview of the underlying industry.

The first Principal Component emphasizes the importance of Working Capital Turnover, and rightly so, given its critical role in explaining the efficiency of capital utilization, inventory management, and establishing strong supplier and customer relationships within the consumer staples industry. Working capital over a given period indicates the level of current assets and current liabilities and for the Consumer Goods conglomerates this becomes the key metric to explain the distinction between them.

The key variable in the second component is Asset Turnover, which sheds light on the company's ability to generate revenue relative to its total assets. This ratio is a critical metric for assessing overall company performance because it represents the efficiency with which assets are used to generate revenue.

The third PC prioritizes EBITDA/Revenue, focusing on the importance of operational efficiency. EBITDA, or earnings before interest, taxes, depreciation, and amortization, provides a broader perspective of a company's ability to convert revenue into operational profit. Given the importance of managing marketing and operating costs in the consumer staples industry, this ratio becomes an important indicator of a company's core operational strength.

The fourth principal component indicates that the debt-to-equity ratio which is a leverage ratio is the next important ratio in the analysis of various consumer staples companies. The D/E ratio measures the amount of debt financing to shareholder's equity for a company. A higher D/E ratio indicates weaker solvency and investment risk. It shows how a company is heavily relied on debt financing. At the same time a very low D/E ratio could also indicate that the company is not utilizing any debt financing for its capital needs. Since too much debt can be a sign of risk for consumer firms, it is important for these firms to maintain a good D/E ratio to ensure stability considering the necessity for constant consumer demand and market stability as consumer staples are usually an indicator of defensive stable stocks.

The fifth and the sixth principal component gives importance to the dividend payout ratio. The dividend payout ratio is the total amount of dividend paid to shareholders in relation to the net income of the company. A high DP ratio indicates that the company is paying out most of its net income to shareholders and not investing it back into the company itself. This is a sign of a mature firm. This ratio makes sense if the analysis is of a consumer staples company as most of these firms are in the mature phase of the business cycle.

The seventh principal component emphasizes on the current ratio. The current ratio is the ratio of the current assets to the current liabilities. The current ratio helps investors understand the companies ability to meet its short term debt obligations with it's current asset's. Consumer staples companies need to ensure a steady supply of products to meet consumer demand. A strong Current Ratio indicates that a company is better equipped to manage day-to-day operations without facing liquidity issues. Maintaining a healthy Current Ratio can instill confidence in suppliers and creditors. This ratio serves as an indicator of a

company's ability to honor its short-term obligations, making suppliers and creditors more willing to extend credit or favorable payment terms, essential in industries reliant on a stable supply chain.

The 8th PC highlights the importance of the return on equity ratio in the analysis of the consumer staples industry. The return on equity ratio assesses a company's efficiency in generating profits from shareholders' equity. In the consumer staples sector, where maintaining profitability is essential due to relatively stable demand for everyday products, ROE serves as a key indicator of a company's ability to generate earnings from invested equity. The Return on Equity ratio holds significant importance in the consumer staples industry by providing insights into profitability, management efficiency, comparative analysis, investor confidence, long-term sustainability, and overall financial health. A strong and consistent ROE is indicative of effective management practices and can influence investment decisions within the consumer staples sector.

The 9th and the last component indicate that the account's receivables turnover ratio is extremely important and needs to be analyzed in detail when it comes to the consumer staples industry. It measures how easily and quickly the firm can collect it's dues from it's customers. In the consumer staples sector, where companies regularly extend credit to customers, managing and collecting receivables promptly is crucial. A higher ART indicates that the company is efficient in converting credit sales into cash, ensuring a healthy cash flow. Consumer staples companies often rely on a continuous cash flow to fund operations, including manufacturing, distribution, and marketing. A higher ART implies quicker conversion of credit sales into cash, supporting ongoing operations and investment in growth opportunities without facing cash flow constraints. This ratio can also help identify potential credit risks.

Finally, our PCA-driven analysis emphasizes the critical importance of specific financial ratios in capturing the dynamics of the consumer staples/goods industry. The importance of Working Capital Turnover, Asset Turnover, and EBITDA/Revenue in assessing the efficiency, financial health, and operational ability of these industry leaders is highlighted by their dominance in the respective principal components. The generated findings provide an intricate understanding, allowing stakeholders and investors in the consumer staples sector to make more informed decisions.

## Conclusion

In conclusion, our research using Principal Component Analysis (PCA) has provided a comprehensive understanding of the consumer staples industry, spanning 15 distinct financial ratios for seven industry-leading companies over an 18-year period. We were able to simplify the complexity of financial data into key insights by using PCA, which reduced dimensionality and highlighted critical factors that shape the dynamics of this sector.

The cumulative variance explained by the first nine Principal Components reached 88.69%, highlighting the importance of the financial ratios chosen in capturing the underlying industry dynamics. Working Capital Turnover emerged as a key metric in the first Principal Component, highlighting its importance in capital utilization and inventory management. This insight is especially useful for comprehending the efficiency.

Other critical aspects are highlighted by the following Principal Components: Asset Turnover, EBITDA/Revenue, Debt-to-Equity Ratio, Dividend Payout Ratio, Current Ratio, Return on Equity, and Accounts Receivables Turnover Ratio. Each of these ratios provides complex insights into consumer staples companies' operational efficiency, financial health, risk management, and strategic decision-making.

Finally, our PCA-driven analysis not only emphasizes the significance of specific financial ratios, but also provides a nuanced understanding of their relationship in capturing the complex nature of the consumer staples industry. Stakeholders and investors in this sector can use these findings to make more informed decisions, considering the many factors that contribute to the long-term success and stability of consumer staples companies.

# Appendix

## MATLAB Script

```
 A
=[AccountsRecievableTurnover,AssetsTurnover,CFOAvgCurrentLiab,CurrentRatio,DebtEq
uityRatio,DividendPayoutRatio,EBITDAMargin,EPS,EVEbitda,FreeCashFlowPerShare,Inve
ntoryTurnover,NetProfitMargin,ReturnOnEquity,TimesInterestCover,WorkingCapitalTur
nover];
 [coeff,score,latent,tsquared,explained] = pca(A)
```

```
coeff = 15×15

    0.1376   -0.0016    0.4348    0.0990   -0.4088    0.3437    0.1902 ⋯
   -0.4281   -0.1066    0.0504    0.0955    0.2122    0.0345    0.1428
   -0.2105    0.0192    0.5276   -0.3682   -0.0337   -0.3110   -0.2170
   -0.2376   -0.0878    0.1345   -0.4383    0.1633   -0.1638    0.6478
    0.3800    0.1183   -0.1728   -0.0864    0.3834    0.1055    0.3498
    0.3331   -0.3013    0.0320   -0.1036    0.2365   -0.2571   -0.1074
   -0.0804    0.4624    0.0738   -0.0552   -0.1306    0.0443   -0.1412
    0.1453    0.2702    0.0691    0.4357    0.1475   -0.0912    0.2833
    0.4439   -0.0355    0.0516   -0.1038    0.1549   -0.1738   -0.2461
    0.3472    0.1289    0.4207   -0.1889    0.0678   -0.0402   -0.0216
      ⋮
score = 126×15

   -1.5513    0.3912   -2.9046   -2.2257   -0.5868    1.7948    0.0353 ⋯
   -0.4065   -0.2269   -2.8929   -0.9233    0.5738   -0.2016   -1.2062
   -0.4390   -1.3525   -2.1160   -0.2951   -0.7775    0.9226   -0.3521
   -2.3448    0.9113   -1.8360    0.3432    0.0057    1.2015    0.9103
   -1.9095   -1.5601    0.6760   -2.4372   -0.9191   -0.0290    0.9234
   -2.2658   -1.5524    1.5153   -1.0263   -0.3305   -0.1164    0.9618
   -0.6627   -1.7528   -0.1441   -0.1452   -0.7804   -0.0624    0.5083
   -0.9876   -1.9293    1.3469    0.0054   -0.3208    0.1293   -0.2229
   -0.8536   -1.1480    1.0444    0.9571   -0.0708    0.1562   -0.6674
   -0.4072   -0.3134    0.1021    1.8724    0.0976    0.6713   -1.1245
      ⋮
latent = 15×1

    3.0571
    2.8525
    1.5944
    1.0799
    1.0034
    0.8788
    0.8105
    0.7901
    0.5978
    0.5178
      ⋮
tsquared = 126×1

   52.7692
   30.2426
   15.9947
   11.7548
   21.6500
    8.9899
    3.4289
    3.7939
    3.8590
    7.0034
      ⋮
explained = 15×1
```

```
   21.4085
   19.9755
   11.1653
    7.5623
    7.0265
    6.1542
    5.6758
    5.5326
    4.1866
    3.6260
      ⋮
```

```
Cumulative = cumsum(explained)
```

```
Cumulative = 15×1

   21.4085
   41.3840
   52.5492
   60.1115
   67.1381
   73.2923
   78.9681
   84.5007
   88.6873
   92.3133
      ⋮
```

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[i] Bhargava, P.D. (2017), "Financial analysis of information and technology industry of India (a case study of Wipro Ltd and Infosys Ltd)", Journal of Accounting, Finance and Auditing Studies, Vol. 3 No. 3, pp. 1-13.
[ii] Mahajan, N. and Yaday, A. (2016), "A financial statement analysis- case study for an industry", International Journal of Engineering and Technical Research, Vol. 5 No. 3, pp. 6-8
[iii] https://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-consumer-business-consumer-products-industry-outlook.pdf
[iv] Abraham, A. (2004), "A model of financial performance analysis adapted for nonprofit organisations", AFAANZ 2004 Conference Proceedings. University of Wollongong: Research Online, Alice Springs, NT, 4-6 July
[v] Altman, E.I. (1968), "Financial ratios, discriminant analysis and the prediction of corporate bankruptcy", The Journal of Finance, Vol. 23 No. 4, pp. 589-609.
[vi] Burja, C. (2011), "Factors influencing the companies' profitability", Annales Universitatis Apulensis Series Oeconomica, Vol. 3 No. 2, pp. 215-224.
[vii] Reginald Masimba Mbona and Kong Yusheng (2019) "Financial statement analysis Principal component analysis (PCA) approach case study on China telecoms industry School of Economics and Finance, Jiangsu University, Zhenjiang, China"
[viii] Kofi-Akrofi, G.Y. (2013), "Profitability analysis of the telecommunications industry in Ghana from 2002 to 2006", Asian Journal of Business Management, Vol. 5 No. 1, pp. 60-76
[ix] Taylor, S.L. (1986), "Analysing financial statements: how many variables should we look at?", The Securities Institute Journal, Vol. 1, April, pp. 19-21.
[x] Rasmus Bro and Age K. Smilde (2014) "Principal component analysis", Department of Food Science, University of Copenhagen, Rolighedsvej 30, DK-1958, Frederiksberg C, Denmark