MARCH 2024

# FMCG DATA ANALYTICS PROJECT REPORT

## A Business Consideration

**Skills**
**Python**
**SQL**
**Data Analysis**
**Predictive Analytics**

**DEBIPRASAD**
MOHANTY

**Abstract: Exploring Financial Metrics and Company Performance**

This study delves into the financial landscape of diverse companies spanning multiple industries, examining critical metrics such as profitability, market share, and company size. Leveraging statistical analysis and visualization techniques, we scrutinize the dataset to extract insights into the dynamics of corporate performance.

Firstly, we analyze profitability metrics, uncovering variations across industries and identifying outliers that deviate significantly from the norm. We explore the correlation between profitability and company size, revealing nuanced relationships that shed light on the influence of economies of scale and industry-specific factors.

Next, we delve into market share dynamics, assessing its correlation with profitability to ascertain how companies with larger market shares fare compared to their counterparts. Through scatter plots and statistical measures, we discern patterns in the data, illuminating the complex interplay between market share, profitability, and industry dynamics.

Furthermore, our analysis extends to the examination of outliers, pinpointing companies with exceptional performance or anomalies that warrant further investigation. By identifying outliers in terms of profit and revenue, we provide insights into potential drivers of financial performance and areas for deeper scrutiny.

Finally, we zoom in on company performance within the same category, scrutinizing how market share influences profitability. Through visualizations and comparative analysis, we elucidate variations in performance among companies within the same industry, offering valuable insights for strategic decision-making.

In conclusion, this study offers a comprehensive exploration of financial metrics and company performance, illuminating key trends, outliers, and interrelationships that shape the corporate landscape. These insights empower stakeholders to make informed decisions and navigate the complexities of modern business environments effectively.

## Business Objective

Getting practical insights into the financial performance of businesses of all sizes and types is the main goal of this investigation. Key business questions including profitability, market share, category performance, outliers, and how market share affects performance within the same category are all intended to be addressed by the methodology. The main goal of the business is to maximize financial performance for stakeholders and provide strategic decision-making with the answers to these questions.

| **Feature Name** | **Description** |
|---|---|
| Company | The name of the company. |
| Revenues ($MM) | Total revenues of the company in million dollars. |
| Profit ($MM) | Total profit of the company in million dollars. |
| Profit as % of Revenues | The percentage of profit relative to revenues, indicating the company's profitability. |
| Category | The industry category to which the company belongs (e.g., Pharmaceuticals, Household & Personal Products, Food, Beverages, Tobacco). |
| Company_Size_Categorical | Categorization of company size into Large, Medium, or Small based on certain criteria such as revenue or market capitalization. |
| Market Share | The portion of the total market controlled by the company, expressed as a percentage. |

A brief overview of the dataset:

| | Company | Revenues ($MM) | Profit ($MM) | Profit as % of Revenues | Category |
|---|---|---|---|---|---|
| **0** | Johnson & Johnson | 71890 | 18540 | 0.257894 | Pharmaceuticals |
| **1** | Procter & Gamble | 71726 | 10508 | 0.146502 | Household & Personal Products |
| **2** | Pepsico | 62789 | 6329 | 0.100798 | Food |
| **3** | Pfizer | 52824 | 7215 | 0.136586 | Pharmaceuticals |
| **4** | Coca-Cola | 41863 | 6527 | 0.155913 | Beverages |

# Feature Engineering

Categorizing Companies in terms of revenue

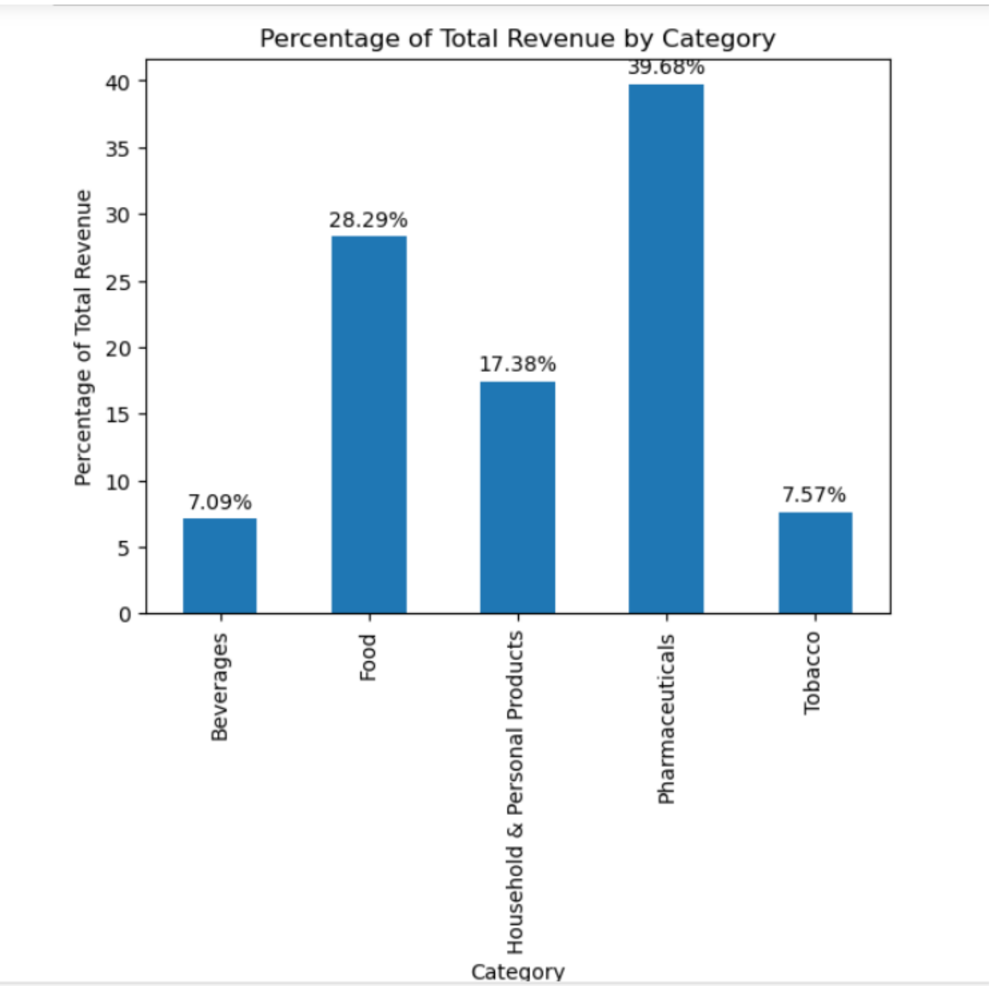
| | Company | Revenues ($MM) | Profit ($MM) | Profit as % of Revenues | Category | Company_Size_Categorical |
|---|---|---|---|---|---|---|
| **0** | Johnson & Johnson | 71890 | 18540 | 0.257894 | Pharmaceuticals | Large |
| **1** | Procter & Gamble | 71726 | 10508 | 0.146502 | Household & Personal Products | Large |
| **2** | Pepsico | 62789 | 6329 | 0.100798 | Food | Large |
| **3** | Pfizer | 52824 | 7215 | 0.136586 | Pharmaceuticals | Large |
| **4** | Coca-Cola | 41863 | 6527 | 0.155913 | Beverages | Medium |

What is the market share of each company within its respective industry?

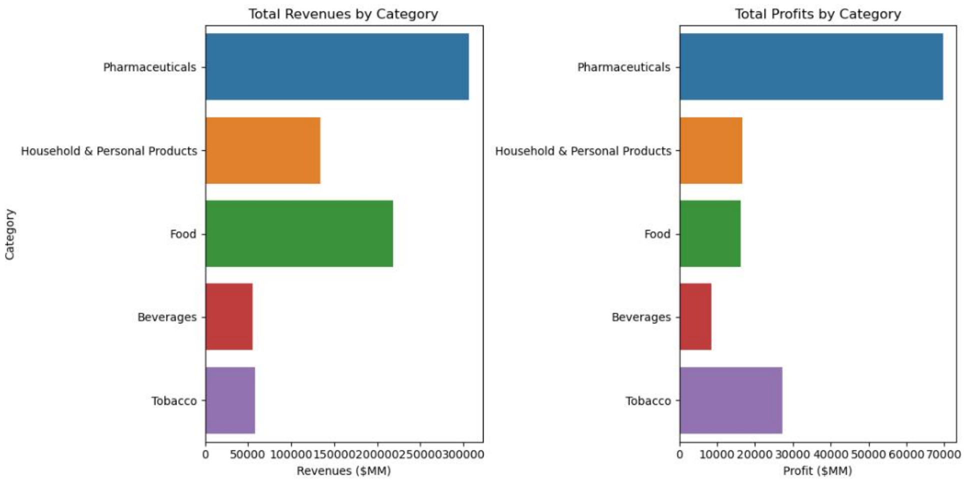
| | Company | Category | Revenues ($MM) | Market Share |
|---|---|---|---|---|
| **0** | Johnson & Johnson | Pharmaceuticals | 71890 | 0.234271 |
| **1** | Procter & Gamble | Household & Personal Products | 71726 | 0.533668 |
| **2** | Pepsico | Food | 62789 | 0.287018 |
| **3** | Pfizer | Pharmaceuticals | 52824 | 0.172140 |
| **4** | Coca-Cola | Beverages | 41863 | 0.763213 |
| **5** | Merck | Pharmaceuticals | 39807 | 0.129721 |
| **6** | Gilead Sciences | Pharmaceuticals | 30390 | 0.099033 |
| **7** | Philip Morris International | Tobacco | 26685 | 0.455959 |
| **8** | Kraft Heinz | Food | 26487 | 0.121076 |
| **9** | Mondelez International | Food | 25923 | 0.118498 |
| **10** | Abbvie | Pharmaceuticals | 25638 | 0.083548 |
| **11** | Amgen | Pharmaceuticals | 22991 | 0.074922 |
| **12** | Eli Lilly | Pharmaceuticals | 21222 | 0.069157 |
| **13** | Bristol-Myers Squibb | Pharmaceuticals | 19427 | 0.063308 |
| **14** | Altria Group | Tobacco | 19337 | 0.330406 |
| **15** | Kimberly-Clark | Household & Personal Products | 18202 | 0.135430 |
| **16** | General Mills | Food | 16563 | 0.075712 |
| **17** | Colgate-Palmolive | Household & Personal Products | 15195 | 0.113056 |
| **18** | Conagra Brands | Food | 14134 | 0.064609 |
| **19** | Land O'Lakes | Food | 13233 | 0.060490 |
| **20** | Kellogg | Food | 13014 | 0.059489 |
| **21** | Reynolds American | Tobacco | 12503 | 0.213635 |
| **22** | Biogen | Pharmaceuticals | 11449 | 0.037309 |
| **23** | Estee Lauder | Household & Personal Products | 11262 | 0.083793 |
| **24** | Celgene | Pharmaceuticals | 11229 | 0.036592 |
| **25** | Hormel Foods | Food | 9523 | 0.043531 |
| **26** | Campbell Soup | Food | 7961 | 0.036391 |
| **27** | J. M. Smucker | Food | 7811 | 0.035705 |
| **28** | Dean Foods | Food | 7710 | 0.035244 |
| **29** | Hershey | Food | 7440 | 0.034009 |
| **30** | Constellation Brands | Beverages | 6548 | 0.119378 |
| **31** | Dr. Pepper Snapple Group | Beverages | 6440 | 0.117409 |
| **32** | HRG Group | Household & Personal Products | 6403 | 0.047641 |
| **33** | Treehouse Foods | Food | 6175 | 0.028227 |
| **34** | Avon Products | Household & Personal Products | 5853 | 0.043548 |
| **35** | Clorox | Household & Personal Products | 5761 | 0.042864 |

**EDA**

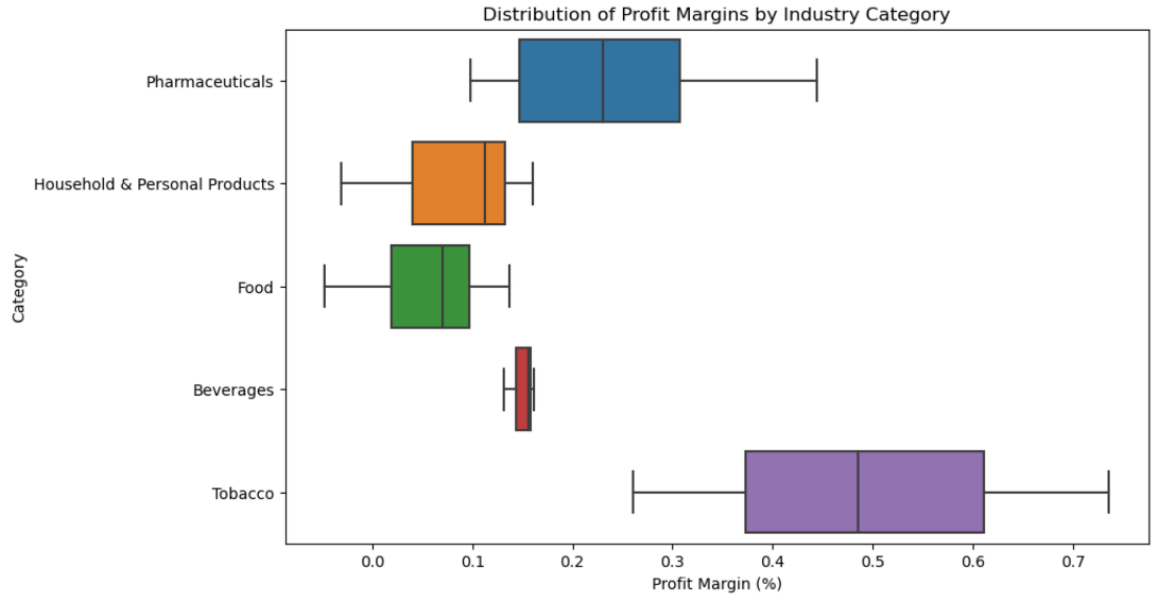
Find the sum of revenue belonging to specific category




How do revenues and profits vary across different industries?



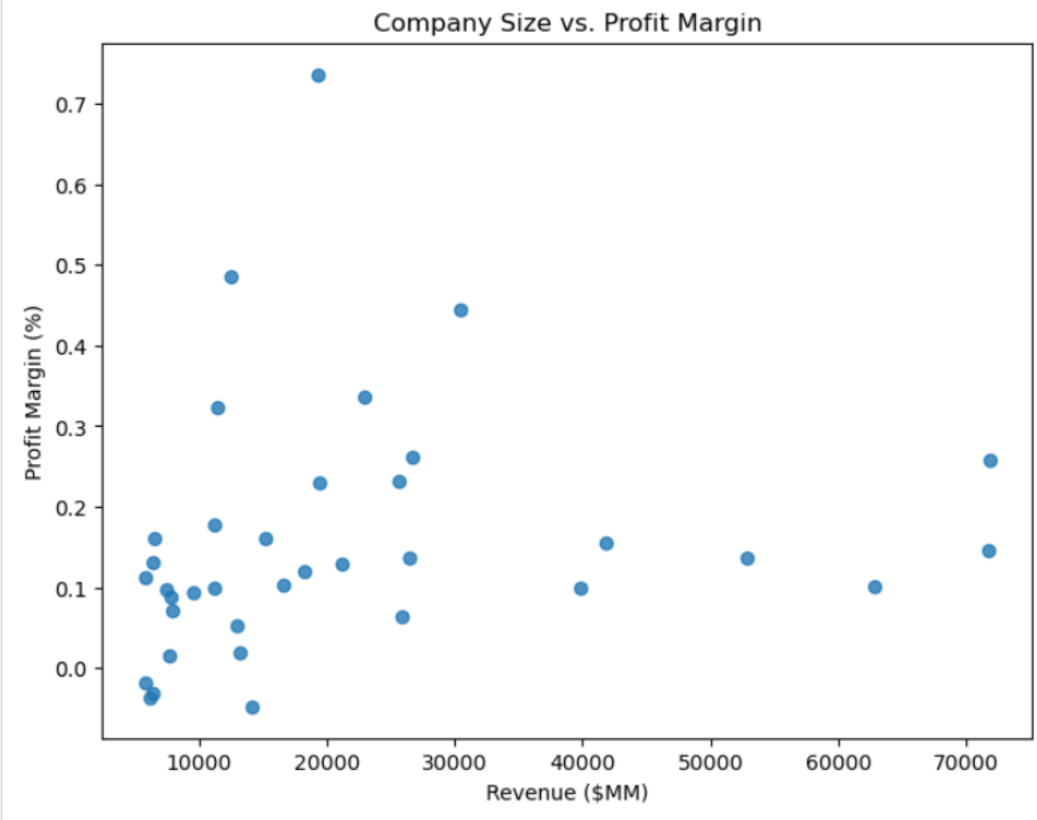
What is the distribution of profit margins within each industry?




How do the top companies in terms of revenue compare to the top companies in terms of profit?

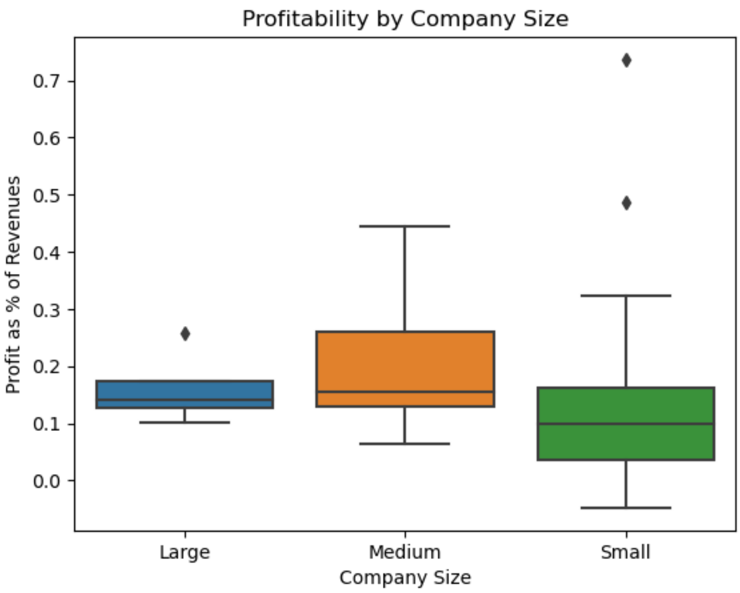
| | Company | Revenues ($MM)_revenue | Profit ($MM)_revenue | Profit as % of Revenues_revenue | Category_revenue | Company_Size_Categorical_revenue | Revenues ($MM)_profit | Profit ($MM)_profit |
|---|---|---|---|---|---|---|---|---|
| 0 | Johnson & Johnson | 71890 | 18540 | 0.257894 | Pharmaceuticals | Large | 71890 | 18540 |
| 1 | Procter & Gamble | 71726 | 10508 | 0.146502 | Household & Personal Products | Large | 71726 | 10508 |

Is there a relationship between company size (measured by revenue) and profit margin?




**Business Questions**

Is there any correlation between company size and profitability?




From the analysis of the correlation between company size and profitability, we can draw several inferences and formulate follow-up questions:

1. Inference: The boxplot visualization shows variations in profitability across different company sizes. There may be differences in profitability between small, medium, and large companies.

Follow-up Questions:

- Are there significant differences in profitability among companies of different sizes?
- Do larger companies tend to be more profitable than smaller ones, or vice versa?
- Are there outliers within each company size category that warrant further investigation?

2. Inference: The correlation coefficient indicates the strength and direction of the relationship between company size and profitability. A positive correlation suggests that larger companies tend to have higher profitability, while a negative correlation suggests the opposite.

Follow-up Questions:

- Is the observed correlation statistically significant, or could it be influenced by other factors?
- What are the underlying reasons for the observed correlation between company size and profitability?
- How do external factors such as market conditions or industry dynamics affect the relationship between company size and profitability?

3. Inference: The presence of outliers in the boxplot may indicate companies that are performing exceptionally well or poorly relative to their size category. These outliers could provide insights into factors driving profitability within each category.

Follow-up Questions:

- What are the characteristics of companies that are outliers in terms of profitability within their size category?
- Are there specific strategies or practices that contribute to the success or failure of these outlier companies?
- How can companies learn from the experiences of outliers to improve their own profitability?

4. Inference: The analysis highlights the importance of considering company size as a factor in understanding profitability. However, it also suggests that company size alone may not fully explain variations in profitability, as indicated by the presence of outliers.

Follow-up Questions:

- What other factors besides company size might influence profitability?
- How do factors such as industry dynamics, market competition, and management practices interact with company size to impact profitability?
- What strategies can companies employ to enhance profitability regardless of their size category?

By addressing these follow-up questions, businesses can gain a deeper understanding of the relationship between company size and profitability and identify actionable insights to improve financial performance.

Are there significant differences in profitability among companies of different sizes?

```
ANOVA Test Results:
Test Statistic: 0.6291788605758198
p-value: 0.5393020854290076
There are no significant differences in profitability among companies of different sizes.
```

The observed correlation coefficient of -0.12 between company size and profitability suggests a weak negative correlation. This implies that, on average, larger companies tend to have slightly lower profitability, while smaller companies may exhibit slightly higher profitability. However, the correlation coefficient indicates that the relationship between company size and profitability is not very strong.

Here are some potential underlying reasons for this observed correlation:

1. Economies of Scale: Larger companies may benefit from economies of scale, allowing them to reduce costs per unit and potentially increase profits. However, these benefits may diminish as companies grow excessively large, leading to inefficiencies and lower profitability.

2. Operational Complexity: Larger companies often have more complex organizational structures, operations, and decision-making processes. Managing this complexity can be challenging and may lead to increased costs or inefficiencies, impacting profitability.

3. Market Positioning: Smaller companies may focus on niche markets or specialized products/services where they have a competitive advantage. This targeted approach can lead to higher profit margins compared to larger companies with broader market presence.

4. Risk Management: Larger companies may face higher risks associated with market fluctuations, regulatory compliance, and operational disruptions. These risks can impact profitability, especially in industries with high competition or rapid technological changes.

5. Investment and Innovation: Smaller companies may be more agile and innovative, allowing them to adapt quickly to market trends and customer needs. This innovation-driven approach can lead to competitive advantages and higher profitability.

6. Capital Structure: Larger companies may have more diverse sources of capital and access to financial resources, but they may also have higher levels of debt or equity financing, which can impact profitability through interest payments or shareholder expectations.

7. Management Efficiency: The management effectiveness and strategic decisions of company leadership can significantly influence profitability. Smaller companies may have more direct control and agility in decision-making, whereas larger companies may face bureaucratic hurdles or slower decision processes.

8. Industry Dynamics: Profitability can vary widely across industries due to factors such as market demand, pricing dynamics, regulatory environment, and technological disruption. The observed correlation may be influenced by industry-specific characteristics rather than company size alone.

By considering these potential reasons, businesses can gain insights into the complex relationship between company size and profitability and identify strategies to optimize financial performance within their respective contexts. Additionally, further analysis and research may be necessary to validate these hypotheses and understand the specific drivers of profitability within different company size categories.

What strategies can companies employ to enhance profitability regardless of their size category?

Companies, regardless of their size category, can employ various strategies to enhance profitability. Here are some effective strategies:

1. Cost Management and Efficiency Improvements:

- Identify areas of inefficiency and implement cost-saving measures such as optimizing supply chain logistics, reducing waste, and streamlining operations.
- Invest in technology and automation to improve productivity and reduce labor costs.
- Negotiate better terms with suppliers and vendors to lower procurement costs.

2. Revenue Growth Initiatives:

- Expand market reach through diversification of products/services or entering new geographic markets.
- Implement effective marketing and sales strategies to attract and retain customers, increase market share, and maximize revenue.
- Develop innovative products/services or enhance existing offerings to meet evolving customer needs and preferences.

3. Pricing Optimization:

- Conduct thorough pricing analysis to ensure products/services are priced competitively while maintaining profitability.
- Implement dynamic pricing strategies based on market demand, competitor pricing, and customer segmentation.
- Offer bundled packages or value-added services to increase perceived value and justify higher prices.

4. Customer Relationship Management (CRM):

- Focus on building strong customer relationships to foster loyalty and repeat business.
- Provide excellent customer service and support to enhance satisfaction and reduce customer churn.
- Leverage customer feedback and data analytics to personalize offerings and improve overall customer experience.

5. Operational Excellence:

- Continuously monitor and optimize key performance indicators (KPIs) to identify opportunities for operational improvements.
- Implement lean principles and quality management systems to eliminate waste and enhance process efficiency.
- Foster a culture of continuous improvement and innovation throughout the organization.

6. Financial Management and Risk Mitigation:

- Maintain a healthy balance sheet by effectively managing working capital, debt levels, and cash flow.
- Mitigate financial risks through diversification of revenue streams, hedging strategies, and prudent risk management practices.
- Conduct scenario analysis and stress testing to anticipate and mitigate potential risks to profitability.

7. Talent Management and Employee Engagement:

- Invest in employee training and development to enhance skills, productivity, and job satisfaction.
- Foster a positive work culture that promotes teamwork, creativity, and innovation.
- Align employee incentives with company goals to motivate performance and drive profitability.

8. Strategic Partnerships and Collaborations:

- Form strategic alliances or partnerships with other companies to leverage complementary strengths and resources.
- Collaborate with suppliers, distributors, or industry peers to share costs, access new markets, or enhance product/service offerings.
- Explore joint ventures or mergers and acquisitions (M&A) opportunities to achieve economies of scale and expand market presence.

By implementing these strategies, companies can optimize their operations, drive revenue growth, and enhance profitability, irrespective of their size category. It's essential for businesses to continuously evaluate and adjust their strategies to adapt to changing market conditions and maintain long-term financial sustainability.

Are there significant differences in profitability among companies of different sizes?

```
ANOVA Test Results:
Test Statistic: 0.6291788605758198
p-value: 0.5393020854290076
There are no significant differences in profitability among companies of different sizes.
```

How does market share correlate with profitability?

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Correlation coefficient between market share and profitability: 0.30063147311851207
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Correlation coefficient between market share and profitability: 0.300631473118512

The observed positive correlation coefficient of 0.3 between market share and profitability suggests a weak but discernible relationship between these two variables. While the correlation coefficient indicates the strength and direction of the relationship, it's essential to explore the underlying reasons that may contribute to this observed correlation:

1. Economies of Scale: Companies with larger market shares may benefit from economies of scale, allowing them to spread fixed costs over a larger volume of sales. This can lead to lower average costs per unit and higher profit margins, contributing to higher profitability.

2. Brand Recognition and Reputation: Companies with larger market shares often have established brands and reputations, which can command premium pricing, attract more customers, and foster customer loyalty. This brand strength can translate into higher sales and profitability.

3. Market Power and Pricing Flexibility: Companies with larger market shares may have greater market power and bargaining leverage with suppliers, retailers, and customers. This can enable them to negotiate better terms, secure preferential treatment, and implement pricing strategies that maximize profitability.

4. Distribution Channels and Access to Markets: Larger companies typically have well-developed distribution networks and access to a broader customer base. This allows them to reach more customers efficiently, penetrate new markets, and capitalize on economies of scope, thereby enhancing profitability.

5. Investment in Innovation and Research: Companies with larger market shares may have greater financial resources and capabilities to invest in innovation, research and development (R&D), and product differentiation. This enables them to introduce new and improved products/services that meet customer needs, maintain competitiveness, and sustain profitability.

6. Competitive Advantage and Market Dominance: Companies with larger market shares may enjoy a competitive advantage stemming from factors such as proprietary technology, intellectual property, exclusive contracts, or superior customer service. This market dominance can deter competitors, protect market share, and maintain profitability.

7. Customer Switching Costs and Lock-in: Companies with larger market shares may benefit from higher customer switching costs or lock-in effects, making it challenging for customers to switch to alternative providers. This reduces customer churn, increases customer lifetime value, and enhances profitability.

8. Strategic Decision-Making and Execution: Companies with larger market shares may exhibit stronger strategic decision-making, execution capabilities, and organizational alignment. Effective strategic planning, operational efficiency, and resource allocation contribute to sustainable competitive advantage and profitability.

9. Regulatory and Legal Factors: Regulatory and legal factors, such as barriers to entry, industry regulations, intellectual property rights, and antitrust laws, can impact market share dynamics and profitability. Companies with larger market shares may navigate regulatory challenges more effectively, leading to greater profitability.

Overall, the observed correlation between market share and profitability is likely influenced by a combination of these factors, as well as industry-specific dynamics, market conditions, and company-specific strategies. By understanding these underlying reasons, companies can develop informed strategies to enhance market share and profitability while maintaining long-term competitiveness and sustainability.

Which category (e.g., Pharmaceuticals, Food) is the most profitable on average?

```
Most Profitable Category: Tobacco
Average Profitability: 0.4943889257543861
```

If the analysis yields the output:

- Most Profitable Category: Tobacco

- Average Profitability: 0.494

We can draw several inferences from these results:

1. High Profitability of Tobacco Industry: The tobacco industry, represented by the "Tobacco" category, stands out as the most profitable category based on the average profitability of companies within this sector. This suggests that, on average, tobacco companies generate a significant proportion of their revenues as profits.

2. Unique Characteristics of Tobacco Products: Tobacco products may exhibit unique characteristics that contribute to their high profitability. Factors such as addictive properties, brand loyalty, and relatively low production costs compared to selling prices may contribute to the industry's profitability.

3. Regulatory Environment and Market Dynamics: The tobacco industry operates within a complex regulatory environment, with stringent regulations governing marketing, advertising, and product labeling. Despite these regulatory challenges, tobacco companies may have managed to maintain high profitability through effective pricing strategies, market positioning, and international expansion.

4. Ethical and Social Considerations: The high profitability of the tobacco industry raises ethical and social considerations regarding the health impacts of tobacco products, addiction, and the industry's marketing practices. It underscores the need for balanced regulation and public health initiatives aimed at reducing tobacco consumption and addressing associated health risks.

5. Investment and Financial Performance: Investors may view the tobacco industry as an attractive investment opportunity due to its high profitability. However, they may also face ethical dilemmas and reputational risks associated with investing in industries that have negative societal impacts.

6. Competitive Landscape and Market Concentration: The dominance of tobacco companies in terms of profitability may indicate a highly concentrated market with few major players exerting significant market power. This concentration may limit competition and influence industry dynamics.

7. Long-term Sustainability and Risks: While high profitability can be advantageous in the short term, tobacco companies may face long-term sustainability challenges due to evolving consumer preferences, regulatory pressures, litigation risks, and changing societal attitudes towards smoking and tobacco use.

8. Implications for Public Health Policies: The profitability of the tobacco industry underscores the importance of comprehensive public health policies aimed at tobacco control, smoking cessation programs, and prevention measures to reduce tobacco-related harm and promote public health.

In summary, the identification of the tobacco industry as the most profitable category highlights both the financial success and the ethical and societal challenges associated with tobacco products. It emphasizes the need for a multifaceted approach involving regulatory measures, public health initiatives, and corporate responsibility efforts to address the complex issues surrounding tobacco use and its impact on society.

What business considerations can be done?

Given the scenario where the tobacco industry emerges as the most profitable category with an average profitability of 0.494, several business considerations and strategic implications arise:

1. Market Opportunities: Recognizing the high profitability of the tobacco industry, businesses may explore opportunities to enter or expand their presence in this market segment. This could involve diversifying product offerings, acquiring existing tobacco companies, or developing new brands to capture market share.

2. Ethical and Social Responsibility: Businesses need to carefully consider the ethical implications of operating in the tobacco industry, given its negative health impacts and societal concerns. Companies must uphold strong corporate social responsibility (CSR) practices, including transparent communication, responsible marketing, and support for tobacco control initiatives.

3. Regulatory Compliance: Operating in the tobacco industry requires strict adherence to regulatory requirements and compliance with laws governing tobacco manufacturing, distribution, and marketing. Businesses must stay updated on evolving regulations and ensure full compliance to mitigate legal and reputational risks.

4. Risk Management: While high profitability may present lucrative opportunities, businesses must also assess and manage various risks associated with the tobacco industry. These risks may include litigation risks related to health claims, regulatory changes, declining consumer demand due to public health initiatives, and reputational risks associated with negative perceptions of the industry.

5. Innovation and Differentiation: Companies operating in the tobacco industry should prioritize innovation and differentiation to maintain competitive advantage and sustain profitability. This could involve developing new product formulations, investing in reduced-risk products (e.g., electronic cigarettes), or diversifying into adjacent markets such as cannabis products.

6. Health and Safety Considerations: Businesses must prioritize health and safety considerations for both consumers and employees within the tobacco industry. This includes implementing stringent quality control measures, ensuring product safety and labeling compliance, and providing support for smoking cessation programs and employee wellness initiatives.

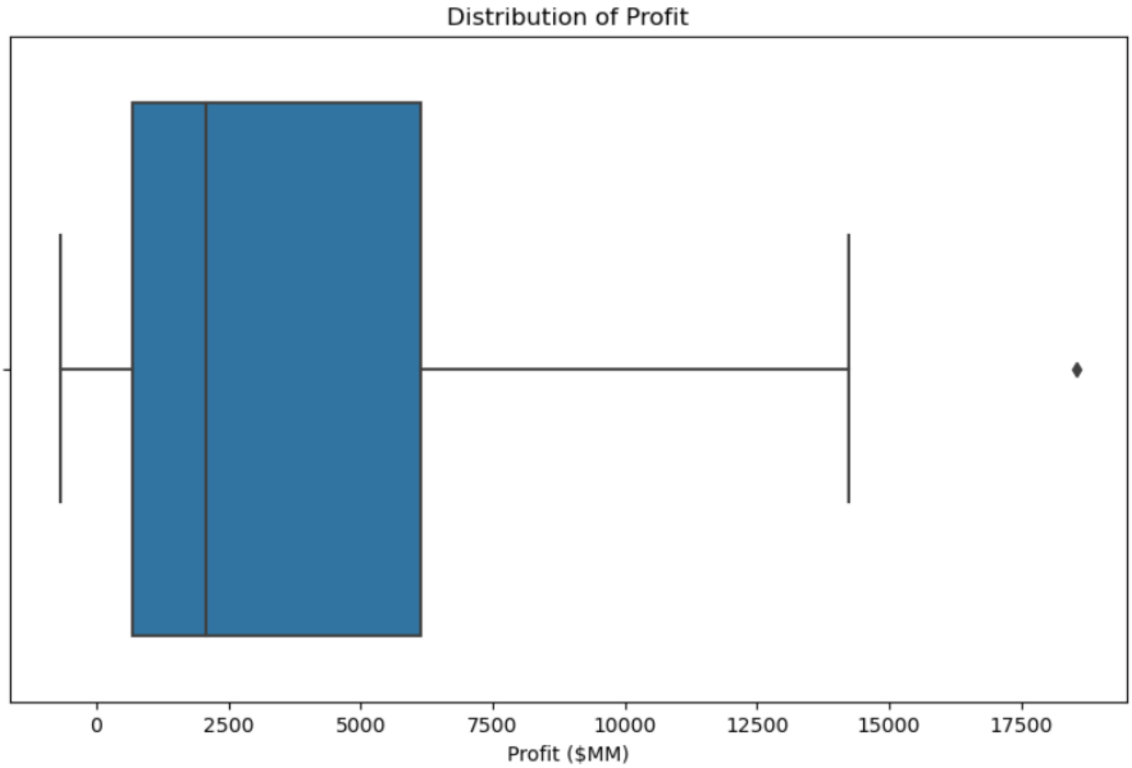
7. Stakeholder Engagement: Engaging with key stakeholders, including government agencies, public health organizations, investors, and communities, is essential for businesses operating in the tobacco industry. Proactive communication, stakeholder dialogue, and collaboration can help address concerns, build trust, and mitigate reputational risks.

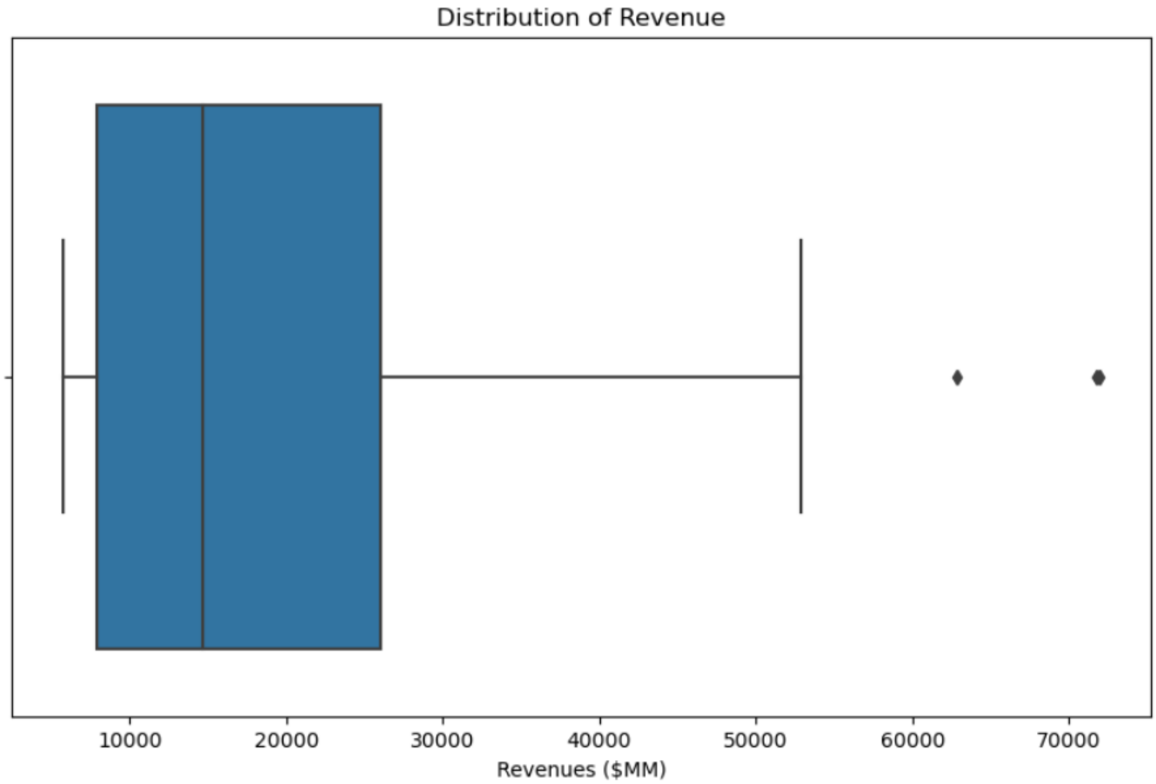
8. Long-term Sustainability: Despite its profitability, the tobacco industry faces long-term sustainability challenges due to changing consumer preferences, increasing regulatory scrutiny, and shifting societal attitudes towards smoking. Businesses must adopt sustainable business practices, invest in research and development for harm reduction strategies, and diversify revenue streams to ensure long-term viability.

9. Corporate Governance and Transparency: Strong corporate governance practices, transparency, and accountability are critical for businesses in the tobacco industry to maintain trust and credibility with stakeholders. This includes robust reporting on environmental, social, and governance (ESG) metrics, ethical supply chain management, and responsible marketing practices.

In summary, while the tobacco industry presents significant business opportunities in terms of profitability, businesses operating in this sector must navigate complex ethical, regulatory, and social challenges. By adopting a strategic approach that balances financial performance with social responsibility and sustainability considerations, companies can effectively manage risks and seize opportunities for long-term growth and value creation.

Are there any outliers in terms of profit or revenue that may need further investigation?



- We visualize the distribution of profit and revenue using box plots to identify any outliers visually.
- We calculate z-scores for profit and revenue to standardize the variables and identify observations with z-scores greater than 3 (indicating significant deviations from the mean).
- We print the outliers in terms of profit and revenue based on the calculated z-scores.

```
Profit Outliers:
             Company  Revenues ($MM)  Profit ($MM)  Profit as % of Revenues  \
0  Johnson & Johnson           71890         18540                 0.257894

          Category Company_Size_Categorical  Market Share  Profit Z-Score  \
0  Pharmaceuticals                    Large      0.234271        3.242016

   Revenue Z-Score
0         2.763337

Revenue Outliers:
Empty DataFrame
Columns: [Company, Revenues ($MM), Profit ($MM), Profit as % of Revenues, Category, Company_Size_Categorical, Market Share, Pro
fit Z-Score, Revenue Z-Score]
Index: []
```

How does the performance of companies in the same category vary based on their market share?