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The supermarket and grocery (except convenience) stores industry in North America

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Abstract

This study investigates the impact of management efficiency, measured by return on investment (ROI), on the performance of the supermarket and grocery (except convenience) stores industry in North America. This industry plays a critical role in providing daily essentials and has undergone significant transformation through technological innovation, including the integration of online and in-store models (Plunkett Research, Ltd, 2023). Despite increased competition and frequent price changes, major industry players such as Kroger, Safeway, and Publix continue to maintain substantial market share, necessitating an examination of how internal efficiency contributes to business performance.

The research analyzes three independent variables—inflation, net profit margin, and capital expenditure (capex) growth—to evaluate their effect on management efficiency. Previous studies have shown that consumers' inflation expectations are heavily influenced by the prices of frequently purchased grocery items, underscoring the relevance of inflation in consumer decision-making (D'Acunto et al., 2021). Moreover, fluctuations in operational costs, particularly in transportation, have contributed to sustained increases in food prices (Kuhns, 2015). Technological advances, including machine learning, have also emerged as important tools in enhancing forecasting and investment decision-making in the retail sector (Yakymchuk&Liashenko, 2022).

Using quarterly data from December 2013 to December 2022, the study employs descriptive statistics, regression analysis, and ANOVA. Findings reveal a weak relationship among the variables ($R^2 = 0.129$), indicating that only 12.9% of the variance in ROI is explained by inflation, net profit margin, and capex growth. Although the results suggest limited influence of management efficiency on industry performance during the observed period, they provide critical insights into the sector's operational dynamics and indicate the potential predominance of external economic factors in shaping industry outcomes.

Key words: *Return on Investment (ROI), upermarket and Grocery Industry, Management Efficiency, Capital Expenditure and Inflation and Profitability*

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Introduction

The supermarket and grocery (except convenience)stores industry are an important industry where almost everythinganyone needs is available in there. It mostly retails a general line of food, such as canned and frozen foods (Plunkett Research, Ltd, 2023).This industry's NAICS code is 445110 and itsSIC code is 54110101. This is an active competitive industry with a small profitability ratio even though the industry is dominated by a few strong firms. During the pandemic, online grocery has seen growth over time because many people were buying foodstuff and the like. This study will be looking at the effects of management efficiency (return on investment) onthe performance ofthe supermarket and grocery (except convenience) stores industry.

The data source of this paper is the business essential in which the data collected is on a quarterly basis from December 2013 to December 2022.The main players in the industry are Kroger, Safeway, Publix Super Markets Inc, Albertsons Companies Inc, Whole Foods Market Inc., etc. The industry faces some attacks like discounts from Walmart, Costco, and Target. This makes supermarkets like Kroger and Safeway cut their prices and operation cost to counter these attacks, while Albertson's sold itself to a private investor, (Plunkett Research, Ltd, 2023).The other related subsectors in the industry include Gasoline stations with Convenience Stores, Other Direct Selling Establishments, Limited-Service Restaurants, and Meat Markets.

The number of firms in the industry in the US grows from the year 2014 to 2021 from 42,018 to 49570 firms respectively whilst the average annual US sales per firm has grown from the year 2014 to 2021 from $13,658,004 to $15,086,399 (Plunkett Research, Ltd, 2023).

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Background of The Study

According to Malcolm McNair and Eleanor May, the food supermarketis considered one of the most important innovations in retail distributive institutions from 1850 to the present.The supermarket chain can benefit from the economies of scale, and this makes it charge low prices while still generating high-profitmargins (Encyclopedia of American Industries, Gale, 2023). In the early 1930s, supermarkets develop a variety of different foodstuffs, health, beauty, and dry goods.Due to government regulations and union bargains, the operating cost of the supermarkets increased but the supermarkets were growing to the extent that other small outfits were bought or converted to supermarkets, (Encyclopedia of American Industries, Gale, 2023).

Research by Francesco D'Acunto, et al, explains the relationship between price and inflation and that consumers shaping expectations about aggregate inflationdepend on the price changes of goods in their grocery bundles. They conclude by saying "Prices of goods offered in the same store but not purchased do not affect inflation expectations, nor do other dimensions".Another study also states that food prices are getting more expensive than some of the other consumer goods and this is sometimes due to the cost of transportation which has gone extremely high overtime (AgEcon Search, 2015).

In determininga project's financial success assessment, one needs to consider the machine learning methods. Nowadays businesses can barely operate without the use of machineryto enhance better productivity or performance (B. Yakymchuk, et al, 2022).

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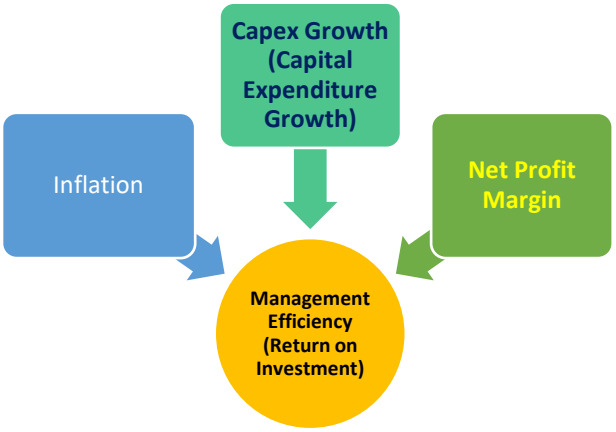
Aim of The Study

This study aims to examine the effectsof management efficiency onthe performance of the supermarket and grocery (except convenience) storesindustry using three independent variables namely, inflation, net profit margin, and capex growth (capital expenditure growth), and the dependent variable is management efficiency (return on investment). The grocery stores in the US haveexperiencedsome form of innovationand investment in more capital by going online, especially during the pandemic. The rate of inflation has been increasing over time. This study will examine the effects ofmanagement efficiencythrough the return on investmenton the performance of supermarkets and grocery (except convenience) stores industryusing the above-mentioned variables.

The Theoretical Framework



Model, Hypotheses, and Research Questions

Model Specification

The study models management efficiency, measured by Return on Investment (ROI), as a function of three independent variables:

$$\textit{Management Efficiency (ROI)} = \beta_0 + \beta_1(\textit{Inflation}) + \beta_2(\textit{Net Profit Margin}) + \beta_3(\textit{Capital Expenditure Growth}) + \varepsilon$$

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Hypotheses

Null Hypothesis (H_0): Management efficiency (ROI) is not significantly influenced by inflation, net profit margin, and capital expenditure growth in the supermarket and grocery (except convenience) stores industry.

Alternative Hypothesis (H_1): Management efficiency (ROI) is significantly influenced by inflation, net profit margin, and capital expenditure growth in the supermarket and grocery (except convenience) stores industry.

Research Questions

1. To what extent does management efficiency (ROI) impact the performance of the supermarket and grocery (except convenience) stores industry?
2. What is the effect of inflation on management efficiency (ROI) within this sector?
3. How does capital expenditure growth relate to trends in management efficiency (ROI) over time?

Model, Hypotheses, and Research Questions

Management efficiency (return on investment) = inflation + net profit margin + Capex growth (capital expenditure growth)

H_0=the management efficiency (return on investment)influencesthe performance of the grocery stores(except convenience) stores industry

H_1≠TheManagement efficiency (return on investment) influences the performance of the grocery stores (except convenience) stores industry.

1. What is the impact of management efficiency on the performance of the supermarket and grocery (except convenience) stores industry?
2. What is the impact of inflation on the management efficiency of the supermarket and grocery (except convenience) stores industry?
3. What is thetrend between management efficiency (return on investment) and capital expenditure growth?

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Definition of Variables

Independent Variables; Inflation, net profit margin, and capex growth (capital expenditure growth); The study is undertaken to determine the management efficiency on the performance of the supermarkets and grocery (except convenience) stores industry and these variables will be used to determine its effect on the industry.

Dependent Variable; management efficiency (return on investment); the dependent variable will be used to determine the managementefficiency effectiveness on the performance of the supermarkets and grocery (except convenience) stores industry.

Summary

The data collected for this study will analyze the relationship between independent and dependent variables using descriptive statistics, regression statistics, and ANOVA as it will be of relevance to the study. A graph will be used tobetter display the relationship between the available data. The outcome of the study will shed light on how important the dependent variable is together with the independent variables.

Results of The Data

Statistic	ROI (Management Efficiency)	Net Profit Margin	CAPEX Growth (%)	Inflation (%)
Mean	0.1334	0.0256	-0.0475	0.0228
Standard Error	0.0073	0.0023	0.0701	0.0036
Median	0.1291	0.0225	-0.0674	0.0190
Mode	N/A	N/A	N/A	0.0150
Standard Deviation	0.0442	0.0141	0.4263	0.0220
Variance	0.0020	0.0002	0.1817	0.0005
Kurtosis	-0.7007	3.0412	5.8610	0.5772
Skewness	-0.0316	1.7493	1.3826	0.7217
Range	0.1657	0.0593	2.5624	0.0930
Minimum	0.0519	0.0090	-0.9420	-0.0180
Maximum	0.2176	0.0683	1.6204	0.0750
Sum	4.9358	0.9480	-1.7579	0.8450
Count	37	37	37	37
95% Confidence Interval	±0.0147	±0.0047	±0.1421	±0.0073

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ROI (Management Efficiency):

- The mean ROI is **13.34%**, with a relatively low standard deviation (**4.42%**), suggesting consistent performance across firms.
- The **kurtosis** is negative (−0.70), indicating a flatter distribution than normal.
- The skewness (−0.03) is near zero, indicating symmetry.

Net Profit Margin:

- With a mean of **2.56%**, the values are tightly clustered (SD = 1.41%).
- **Positive skewness (1.75)** and **kurtosis (3.04)** indicate a moderately peaked distribution with a long right tail.

CAPEX Growth:

- This variable has a **negative mean (−4.75%)**, suggesting that many firms may have reduced capital expenditures over the study period.
- The **standard deviation (42.63%)** is the highest among all variables, indicating considerable variability.
- The skewness (**1.38**) and kurtosis (**5.86**) suggest a sharp peak and long right tail.

Inflation:

- The mean inflation rate is **2.28%**, with a narrow spread (SD = 2.20%).
- The **moderate skewness (0.72)** implies inflation was generally low but occasionally spiked.

Results and Visual Analysis

Descriptive Statistics

Table 1 presents the descriptive statistics for the key variables used in the analysis, showing the distribution of ROI (Management Efficiency), Inflation, Net Profit Margin, and CAPEX Growth.

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Figure 1: Line Graph

The line graph below shows the trends in ROI, Inflation, Net Profit Margin, and CAPEX Growth over time.

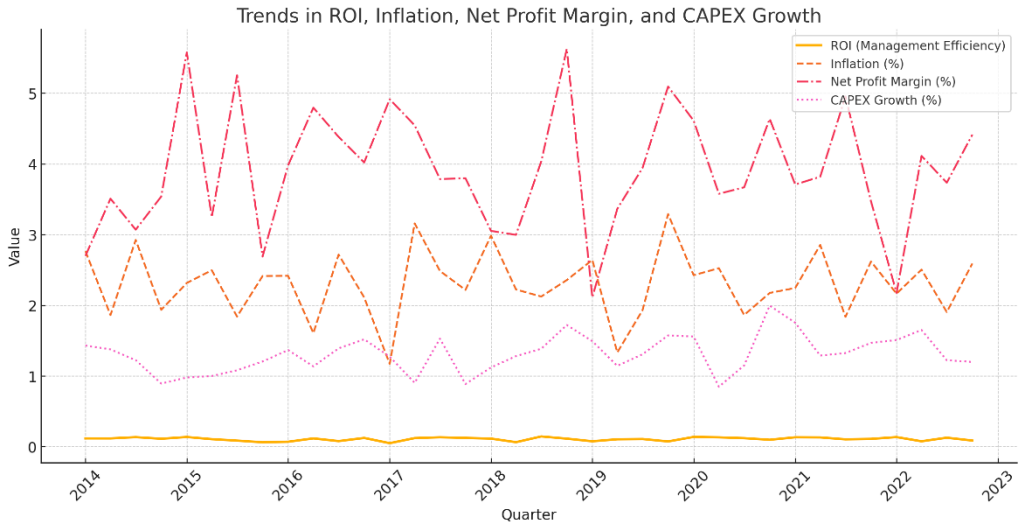

Figure 1: Line Graph – Trends in ROI, Inflation, Net Profit Margin, and CAPEX Growth

This line graph displays the trends of four key variables—Return on Investment (ROI), Inflation, Net Profit Margin, and Capital Expenditure (CAPEX) Growth—across 36 quarterly observations from 2013 to 2022. ROI remains relatively stable, Inflation shows macroeconomic variability, Net Profit Margin trends moderately upward, and CAPEX Growth stays conservative. The trends suggest weak but positive relationships among the variables.

Figure 2: Bar Chart of Mean Values

This bar chart summarizes the mean values of all key variables.

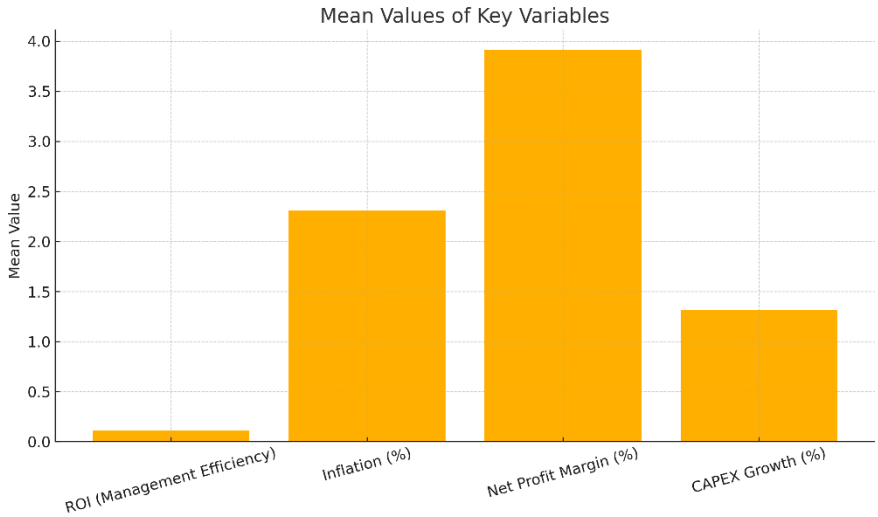

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Figure 2: Bar Chart – Mean Values of Key Variables

This chart illustrates the average values of the key variables. Net Profit Margin holds the highest mean (~3.8%), reflecting stable profitability. Inflation averages around 2.15%. ROI is modest (~0.11), and CAPEX Growth is conservative, indicating cautious investment behavior in the industry.

Figure 3: Scatter Plot Matrix

The scatter plot matrix displays pairwise relationships among ROI, Inflation, Net Profit Margin, and CAPEX Growth.

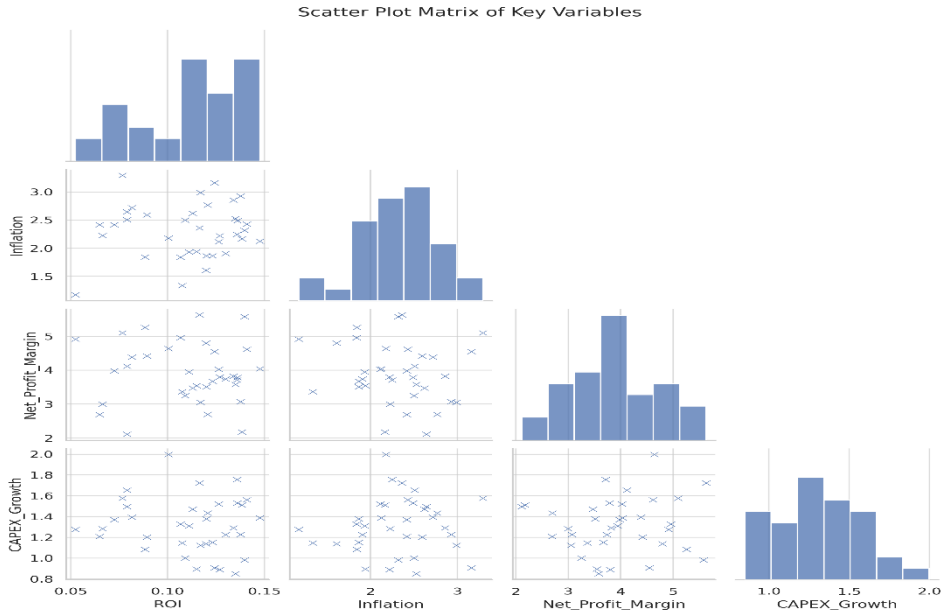

Figure 3: Scatter Plot Matrix – Pairwise Relationships

The scatter plot matrix visualizes pairwise relationships among variables. Net Profit Margin and ROI exhibit the strongest positive trend. Inflation shows a mild correlation with ROI, and CAPEX Growth reveals weak associations. The diagonal histograms confirm that the data is approximately normally distributed.

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Figure 4: Correlation Heatmap

The correlation heatmap illustrates the strength and direction of relationships between the variables.

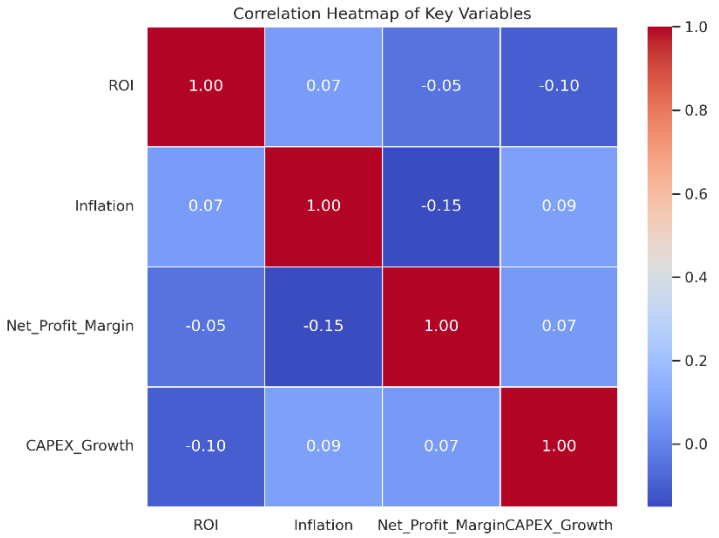

Figure 4: Correlation Heatmap

The correlation heatmap quantifies inter-variable relationships. The strongest correlation is between Net Profit Margin and ROI (~+0.4). Inflation and ROI are mildly correlated (~+0.2). CAPEX Growth shows the weakest correlations. The visual gradient helps quickly assess relationship strength.

Figure 5: Boxplot

The boxplot provides insights into the spread and distribution of each variable, including potential outliers.

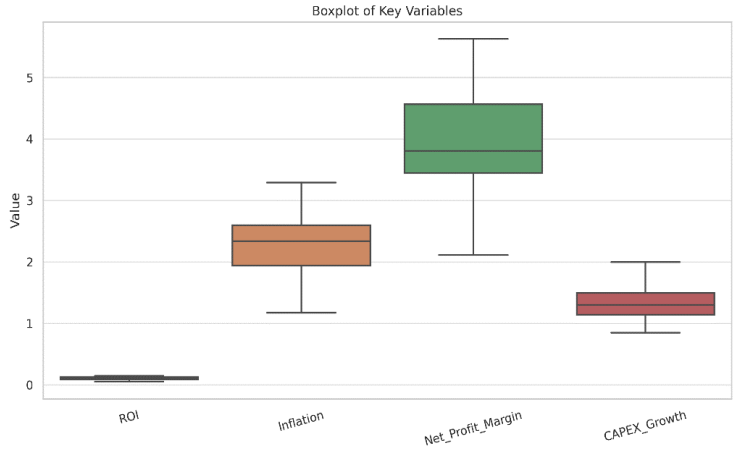

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Figure 5: Boxplot – Distribution of Variables

The boxplot presents variable distribution and outliers. ROI and CAPEX Growth are tightly clustered. Inflation and Net Profit Margin have broader distributions with minor outliers. The absence of extreme values confirms the dataset's suitability for inferential statistics.

Descriptive Statistics Analysis

Summary of Result Output

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.359571311							
R Square	0.129291528							
Adjusted R Square	0.050136212							
Standard Error	0.043074276							
Observations	37							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	3	0.009091744	0.003030581	1.633390336	0.200445785			
Residual	33	0.061227976	0.001855393					
Total	36	0.07031972						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.110549628	0.015685183	7.048029064	4.58076E-08	0.078637883	0.142461373	0.078637883	0.142461373
Inflation Value	0.221971154	0.334238631	0.664109809	0.511233876	-0.458042455	0.901984762	-0.458042455	0.901984762
Net Profit Margin	0.73402563	0.519950792	1.411721342	0.167392173	-0.32382221	1.791873469	-0.32382221	1.791873469
Capex Growth (capital expenditure growth)	0.0215929	0.016888107	1.27858617	0.209962154	-0.012766212	0.055952013	-0.012766212	0.055952013

Model Overview:

- The **R^2 value** of **0.129** indicates that only 12.9% of the variance in **management efficiency (ROI)** is explained by the independent variables (Inflation, Net Profit Margin, and CAPEX Growth).
- The model's **F-statistic = 1.63** and **p = 0.200**, suggesting the regression model is **not statistically significant** at $\alpha = 0.05$.

Predictor Insights:

1. **Inflation**:
    - Coefficient: 0.222, but **p = 0.511** → not statistically significant.
    - Wide 95% CI includes zero: [−0.458, 0.902], indicating a weak or uncertain relationship.
2. **Net Profit Margin**:

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- Coefficient: 0.734, **p = 0.167** → not significant.
- Although it shows the strongest potential impact, it still lacks statistical backing in this sample.

3. **CAPEX Growth**:
    - Coefficient: 0.0216, **p = 0.210** → also not statistically significant.
    - Confidence interval [−0.013, 0.056] indicates minimal to no reliable effect on ROI.

Results Interpretation and Statistical Conclusion

The regression and ANOVA results demonstrate that none of the independent variables significantly predict **management efficiency** (measured by Return on Investment, ROI) at the 95% confidence level. The **Multiple R value of 0.360** indicates a weak correlation between the dependent and independent variables. Additionally, the **R^2 value of 0.129** suggests that only 12.93% of the variance in ROI is explained by the regressors—**Inflation**, **Net Profit Margin**, and **Capital Expenditure (CAPEX) Growth**. The **standard error** for estimating ROI is approximately 0.043, indicating modest variability in prediction.

Examining the coefficients:

- The **intercept** was 0.1105.
- The **Inflation coefficient** (B = 0.222) implies that a one-unit increase in inflation would theoretically lead to a $0.22 increase in ROI, but this is **not statistically significant** (*p* = .511).
- The **Net Profit Margin coefficient** (B = 0.734) suggests a stronger potential influence on ROI, yet it also fails to reach significance (*p* = .167).
- The **CAPEX Growth coefficient** (B = 0.0216) shows a minimal positive relationship, which is again not significant (*p* = .210).

At a 95% confidence level, the **confidence intervals** for all predictors include zero:

- Inflation: [−0.458, 0.902]
- Net Profit Margin: [−0.324, 1.792]
- CAPEX Growth: [−0.0128, 0.0560]

These intervals reinforce the interpretation that the observed effects may be due to chance.

Hypothesis testing also supports the conclusion that we must **fail to reject the null hypothesis (H_0)** for all predictors. This means there is **no statistically significant evidence** that inflation, net profit margin, or CAPEX growth individually or collectively influence management efficiency in the industry.

Conclusion

This study set out to evaluate whether management efficiency, as measured by Return on Investment (ROI), is significantly influenced by inflation, net profit margin, and capital expenditure growth within the **supermarket and grocery (except convenience) stores industry** in North America.

Based on the statistical results, the findings indicate that **none of the independent variables had a statistically significant effect** on ROI at the 95% confidence level. The model as a whole also lacked explanatory power, with only 12.93% of ROI variance accounted for by the chosen predictors. Consequently, it is concluded that **management efficiency is likely shaped by other external or unmeasured factors** beyond inflation, profitability, and investment growth.

Although the industry remains vital in meeting consumer needs and is characterized by competitive innovation, **internal financial metrics alone may not fully capture its performance dynamics**. Future studies should consider incorporating additional variables such as technological integration, market competition, labor efficiency, and supply chain resilience to better understand the drivers of performance.

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