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'NAVIGATING VOLATILITY: A 24-YEAR RISK-RETURN ANALYSIS OF APPLE AND SAMSUNG STOCKS'

'FINAL REPORT'



**Northeastern
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PROBLEM STATEMENT:

Investors need to feel confident to make good judgments through the turbulent waters of modern finance. Large firms, particularly Apple and Samsung, reflect not only the performance graph of the global stock market but also define their course. Investment in the stock market has a lot of growth potential, but it is also filled with challenges. Market volatility can make investors emotional and sometimes cause them to buy high or sell low. Lack of reliable information may result in poor investment choices, while emotional biases like fear or greed often distort judgment. There can be various risk economic uncertainties like inflation, and policy-related changes, among others, in predicting market trends. This leaves less time and resource capacity for retail investors than it is accessible for an institutional investor. Any historical analysis of such company stocks gives more context to the investor to maximize returns with the management of risk. The project will attempt to study the behavior of Apple and Samsung's stock prices for two decades from 2000 to 2023.

The historical data for this analysis was sourced from Nasdaq [1], Apple Inc. (AAPL) Historical Data will allow us to perform a full Descriptive Statistical Analysis of the stock trends for both Apple and Samsung. Based on the 24-year dataset, relevant measures of central tendency such as the Mean and Median will be calculated. The combined dataset sourced from M. Anand, "Apple Stock Price Dataset" [2], and M. Anand, "Samsung Stock Price Dataset"[3] from Kaggle, would then be graphically represented in various forms of graphs depicting these stock trends. This will allow us to perform trend analysis for a better understanding of the historical performance of each stock, thereby ascertaining their respective potential strengths and weaknesses over time.

Geopolitical events will be assessed to clarify their impact on the world stock market and company performance. Finally, the report will consider market sentiment and investor confidence because these factors alone drive stock prices upwards or result in sell-offs at times of uncertainty.

PROJECT GOALS:

This project discusses the stock price behavior and performance of two major technology companies, Apple and Samsung, over 23 years. It aims to provide data insights into historical trends, the risk-return profile, and a comparative analysis. The detailed explanation of each project's objective for the real world to understand the approach taken is as follows:

1. **Descriptive Statistical Analysis Objective:** A basic statistical summary of stock prices for Apple and Samsung will be performed. The goal here is to understand the basic statistical properties of each stock. We shall compute metrics such as Mean and Median, to perceive the central tendency of the stock price within that period.
2. **Trend Analysis of Stock Price Objective:** Consider historical price trends of both companies for the period to be selected. The goal here is to identify certain meaningful trends and patterns in stock price movement for both Apple and Samsung. The analysis of the stock price trends, time series charts, and histograms in this project will enable us to understand seasonal and random trends of the stock price trends.

3. **Risk vs. Return Analysis Objective:** To provide a risk-return trade-off comparison between Apple and Samsung. This objective is about how much value the stock has created over time and is usually measured as a percentage. The Sharpe Ratio is the most important metric used for this analysis. It will help determine how much excess return a stock provides for a given level of risk. The higher this number is the better the compensation for the taken risk. This is imperative because investors must consider the trade-off between risk and reward. From this analysis, we will be in a better position to make an improved investment recommendation. Standard Deviation will become a very important factor in understanding the scattering of stock prices, which in essence means volatility.
4. **Macroeconomic Influence:** To analyze the impact of these macroeconomic factors on Apple and Samsung's stock performance since 2000, we'll need to examine the influence of each factor over this period. Here's how each of these factors typically affect stock prices and an outline of key periods where their impact would be significant for Apple and Samsung;
 - a. **Inflation Rate:** Inflation erodes purchasing power, potentially increasing production costs and impacting consumer demand. Higher inflation usually leads central banks to raise interest rates, which can tighten monetary policy and reduce stock prices. Using scatter plots we will be inferring its effects on the adjusted close stock prices of Apple and Samsung.
 - b. **Exchange Rate:** Exchange rates influence the probability of multinational corporations. A strong domestic currency can reduce revenue from foreign markets when converted back, while a weak currency can increase competitiveness abroad. Overlay lines will be used to infer the effects on the adjusted close stock prices of Apple in USD and Samsung in KRW.
 - c. **Geopolitical Events:** The role of geopolitical events related to the stock exchange factor is quite great. The tensions brought about during these events may affect trade, supply chains, and investor confidence, thus setting off companies with either a global supply network or considerable market reliance. The summary table will detail the variations due to geopolitical events, indicating market sensitivity to news or risks.
5. **Market sentiment and Investor confidence:** Market sentiment and investor confidence are critical concepts in the stock exchange that directly influence stock prices and market trends. Using the concept of a correlation matrix, a heatmap or scatter plot of correlation coefficients between stock returns and market indices or sector benchmarks will be used. This analysis will help deliver insights into how investor sentiment about the broader market or sector affects each company. Investor confidence is a measure of how secure and optimistic investors feel about the market's stability and potential for growth.

DATA COLLECTION:

1. Data Source: For the last two decades, historical stock data for Apple and Samsung were sourced from Kaggle and Yahoo Finance. Kaggle is considered our prime data source, owing to its reliable and complete datasets required for any financial analysis. In this paper, the following datasets are used:

- a. **Apple Stock Dataset:** This dataset contains historical stock prices for Apple Inc. from 2000 to 2023 [1][2][5].
- b. **Samsung Stock Dataset:** This dataset provides historical stock prices for Samsung Electronics over the same period [3][4].
- c. **Exchange Rate Dataset:** This dataset contains the average annual exchange rates between South Korean Won (KRW) and US Dollar (USD) from 2000 to 2023[6].
- d. **Inflation Rate Dataset:** This dataset contains the yearly global inflation rates from 2000 to 2023, which helps analyze macroeconomic scenarios[7].

2. Data Cleaning: The stock prices of Apple and Samsung are compared by converting Samsung's prices from South Korean Won to US dollars. The average annual exchange rate used for this conversion is based on the annual stock data referenced in this study. This conversion is necessary to ensure that the stock prices are comparable, allowing for more accurate analysis and better positioning of their performance to the global market.

3. Data Usage: Datasets have been utilized individually to extract the relevant parameters for the stock analysis. For instance, the datasets for Apple and Samsung were used to analyze trends and assess returns to the risk. The Exchange Rate dataset was utilized to convert Samsung's stock prices from KRW to USD, allowing for a fair comparison with Apple's stock prices. The Inflation Rate dataset was employed to evaluate the impact of inflation on stock performance and to assess purchasing power over the years.

4. Data: The following is a summary of the key variables for all three datasets:

a. Apple & Samsung Dataset Variables:

Date: The date of the entry of a particular stock.

Open: The opening price of the stock on a given date.

High: The highest price at which the stock was traded on that date

Low: The lowest price at which that stock was traded on the given date

Close: The closing price of both stocks on the given date

Adj Close: The adjusted closing price for corporate actions, such as dividends, stock splits, and rights offerings.

Volume: Total number of shares traded on a particular date.

b. Variables in Exchange Rate Dataset:

Date: The year for which the exchange rate data was collected.

Avg Exchange Rate: The average exchange rate of the South Korean Won to the US Dollar for each year.

c. Variables in the Inflation Rate Dataset:

Date: The year in which the inflation data was recorded.

Inflation Rate: The annual inflation rate, in percent, indicates the percent increase in the general price level of goods and services.

5. Major Variables of Interest: The two most critical variables in the analysis were Open and Close. These two variables were used because when the markets are closed, buying and selling of stocks can be done after markets. Because of this reason, on the next day, the open price changes and is not the same as the closing price of the previous day. Adjusted close price varies from close price because it includes the price change when stock splits and dividends are announced by the company. These were used in this research to conduct a comprehensive statistical analysis of stock trends, assess volatility, and analyze risk versus return for both Apple and Samsung.

6. Target Population: The target population of the study includes all stock price data and any market conditions that may influence the stock prices of both the companies, Apple and Samsung. This includes daily stock prices, trading volumes, as well as macroeconomic factors such as interest rates, inflation, and exchange rates. The population further consists of every trading day within the chosen period of analysis, ensuring comprehensive coverage of all relevant data points.

DATA VISUALIZATION:

1. Line Chart Analysis:

The statistical analysis compares the opening and closing prices of the stock performances of Apple and Samsung over a 24-year analysis. The dataset for 24 years of stock prices of Apple and Samsung.

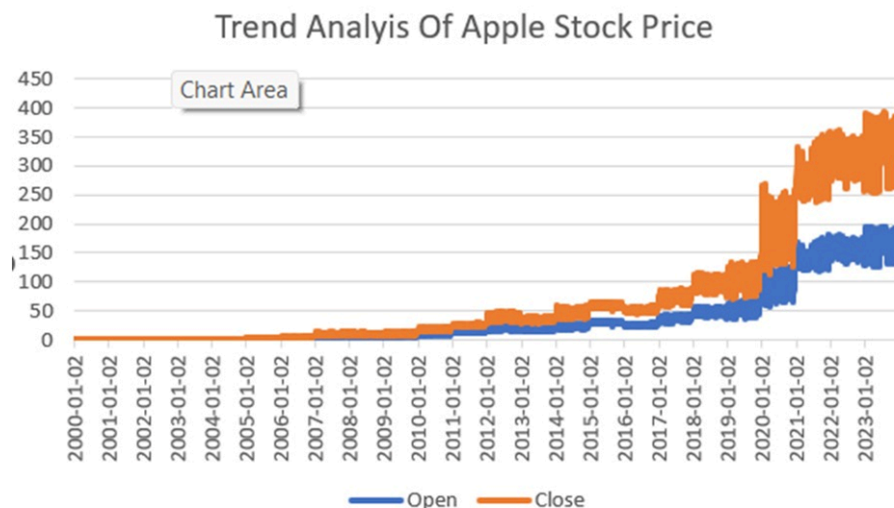


Fig. 1. Open Vs Close prices of Apple

From Fig. 1, one can infer the opening and closing prices of Apple stock from the year 2000 to 2023. From 2000 to 2012, prices have been on a gradual upward trajectory due to successes such as the iPod and early iPhones. Starting in 2012, stock prices surged exponentially with advanced product launches and growth in global markets. Between 2020 and 2023, fluctuations happened, reflecting COVID-19 impacts and recovery phases. The trend indicates the development of Apple into a global technological leader, characterized by continued growth, innovation, and resistance to market downturns.

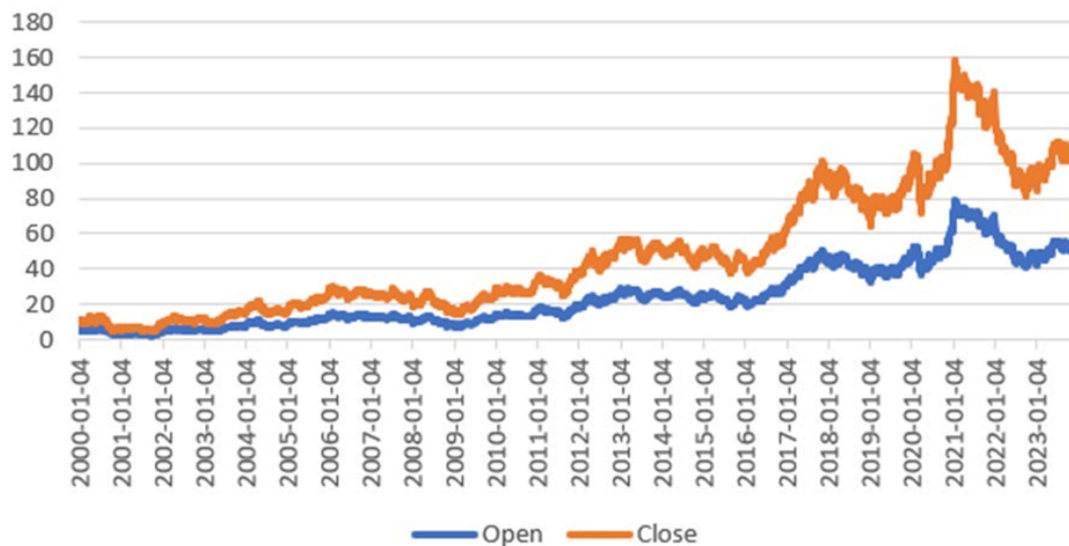


Fig. 2. Open Vs Close Prices of Samsung

Fig. 2 depicts the opening and closing stock trends of Samsung from the year 2000 to 2023: the growth is long-term, while the closing prices mostly stay above the opening ones, reflecting high trading performance. Spikes in 2017 and 2021 can be correlated with milestones in business. After peaking in 2021, prices fell but rose sharply in 2023, evoking volatility and recovery. The trend reflects the growth of Samsung through ups and downs, showing resilience and investor confidence in a dynamic tech industry.

2. Comparative Boxplots:

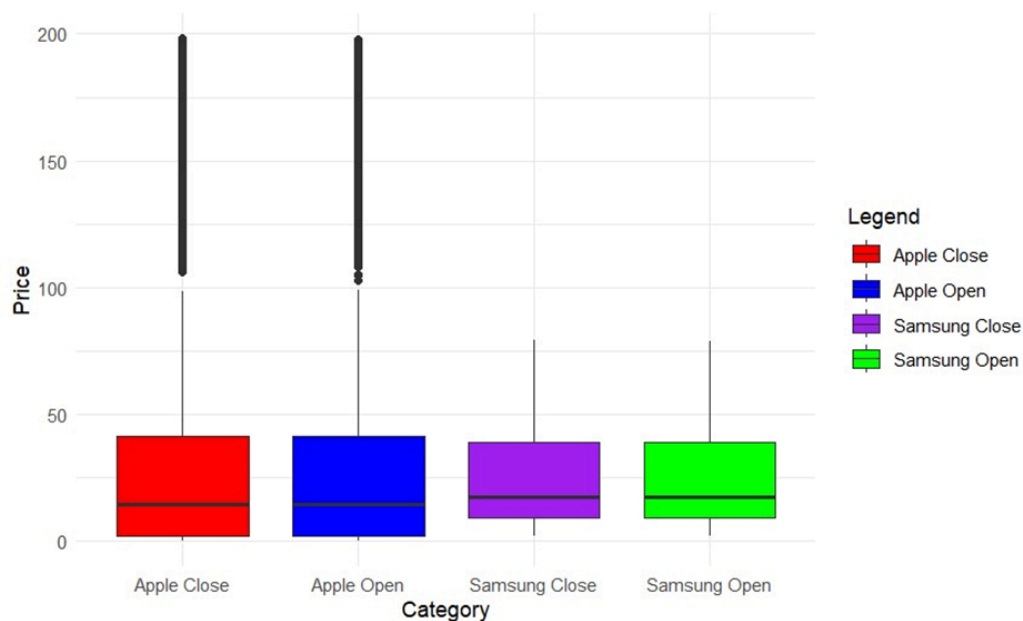


Fig. 3. Comparative Box Plots Of Apple And Samsung

Fig. 3 highlights key insights into Apple and Samsung's stock prices. Apple's median Open and Close prices are higher, indicating generally higher stock values. Both companies have similar Open and Close medians, reflecting low intra-day variability. Apple's broader box width and taller whiskers suggest greater price variability and a wider range of fluctuations. In contrast, Samsung's smaller IQR and shorter whiskers reflect more consistent, stable pricing. Apple exhibits more outliers, often tied to key events like product launches or earnings announcements, while Samsung has fewer, signaling steadier performance. Overall, Apple's stock shows higher prices, greater volatility, and sensitivity to market or company-specific factors. Samsung offers a more predictable, less volatile performance, appealing to risk-averse investors. These trends reflect Apple's growth trajectory and market influence versus Samsung's consistent and stable approach.

MACROECONOMIC INFLUENCES:

1. Inflation Rate:

During periods of low to medium inflation, the stocks of both Apple and Samsung are growing, though Apple is kept at relatively higher prices. High inflations relate to smaller stock values; for Apple, it was more volatile, while for Samsung, it showed more stable but still downward tendencies.

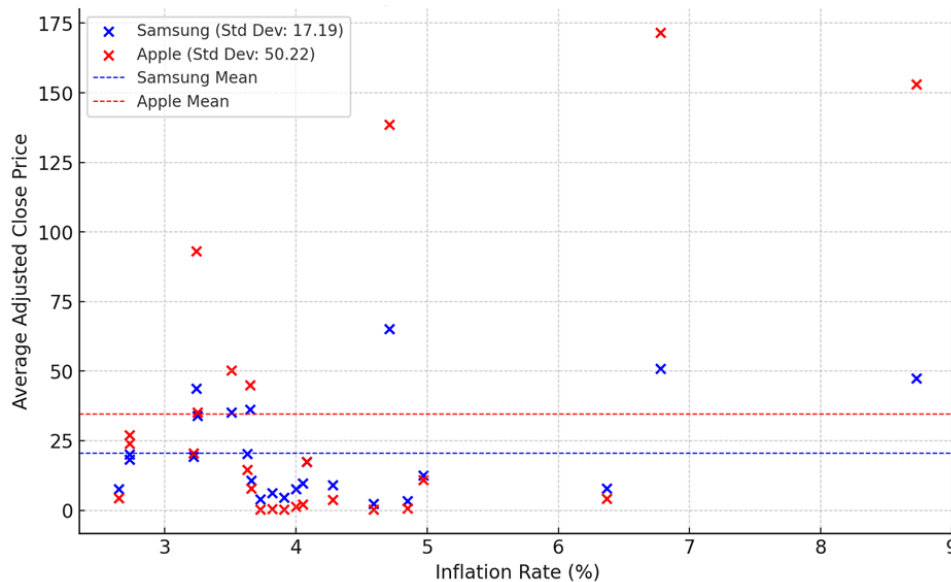


Fig. 4. Correlation Analysis of Inflation Rate and Stock Prices

Fig. 4 analyzes the relationship between inflation rates and the adjusted close prices of Samsung and Apple stock. Apple shows a stronger correlation ($R = 0.56$) with inflation than Samsung ($R = 0.30$). Apple's stock prices are more volatile, with a higher standard deviation (50.22) compared to Samsung's (17.19). While Samsung's prices exhibit a weak upward trend and relative stability, Apple's prices increase more notably with inflation. The mean adjusted close price for Apple is slightly higher, as shown by the dashed horizontal lines. Data points for both stocks cluster between inflation rates of 3% and 5%, with few extreme values. Inflation impacts Apple more significantly than Samsung, but weak correlations suggest other influencing factors. Apple's high variability indicates greater sensitivity to market conditions. This analysis highlights relative inflation-related risks and opportunities for investors.

2. Exchange Rate:

The exchange rate is a key macroeconomic influence, as the currency of weaker countries and stronger countries have adverse effects on the volatility of stocks of both Samsung and Apple. The exchange rate is shown by considering two overlay lines, one showing the stock price in KRW and another showing the converted price in USD, to show the effect of exchange rate fluctuations. The objective here is to observe how the stock price of a non-USD company (in this case, the Korean company Samsung) changes when converted to USD over time.



Fig. 5. Exchange Rate Impact on Samsung Stock Price (KRW to USD)

Analyzing Fig. 5, the blue line represents Samsung's stock price in Korean won while the green line represents Samsung's stock price in US dollars. The exchange rate fluctuates based on economic indicators, political stability, interest rates, etc. When the Korean Won weakens against the USD, then the value of a stock priced in Won would be lower when converted to USD, and vice versa. Exchange rate changes can affect the real return on investment to the investor who is either comparing the two markets or investing in both markets. While investing in stock denominated in Korean Won, if the Won depreciates against the USD, the returns would be lower when you translate them back to the USD. Exchange rate changes introduce currency risk. Many investors would use hedging strategies to reduce potential losses from adverse movements.

3. Geopolitical Events and Stock Performance Analysis:

Table 1 shows how the stock price of Apple fluctuated in terms of the change in value of opening and closing price due to the key geopolitical events mentioned below:

- Dot-com Bubble Burst (2000):** The stock declined amid the tech industry collapse.
- 2008 Financial Crisis:** A huge drop in the stock occurred due to global economic instability.
- US Credit Rating Downgrade (2011):** The stock value decreased during market uncertainty.
- COVID-19 Pandemic (2020):** The stock rose as demand for tech increased rapidly.

This analysis of Apple's stock showcases both its vulnerability during economic crises and its resilience in times of technological demand.

Event	Open	Close	Change
Dot-com Bubble Burst	0.966518	0.271205	Decrement
2008 Financial Crisis	7.008214	6.117857	Decrement
US Credit Rating Downgrade	13.952143	12.631429	Decrement
COVID-19 Pandemic	74.059998	122.940002	Increment

Table 1: Changes in Apple's open and close prices due to geopolitical events

Table 2 analyzes Samsung's stock performance during significant geopolitical events, showing fluctuations based on opening and closing prices.

- a. **Dot-com Bubble Burst (2000):** The stock experienced a clear decline as the broader tech industry struggled with major setbacks during the collapse of the dot-com bubble.
- b. **2008 Financial Crisis:** Samsung's stock value dropped during the global financial downturn, driven by widespread economic instability and market uncertainty.
- c. **US Credit Rating Downgrade (2011):** A decrease was observed during this period, as concerns over the US credit downgrade impacted global markets, including Samsung's valuation.
- d. **COVID-19 Pandemic (2020):** The stock experienced declined, due to the adverse effects of the pandemic on the global market.

This analysis shows how external economic events have influenced Samsung's stock, revealing its challenges during downturns and its ability to adapt when demand for technology surged.

Event	Open	Close	Change
Dot-com Bubble Burst	4.528528847259444	2.812640963727545	Decrement
2008 Financial Crisis	9.12397173926845	7.474146035725477	Decrement
US Credit Rating Downgrade	15.43168097030078	13.91558599778	Decrement
COVID-19 Pandemic	47.03190542773611	38.81191474937503	Decrement

Table 2: Changes in Samsung's open and close prices due to geopolitical events

RISK VS RETURN ANALYSIS: APPLE VS SAMSUNG

This analysis evaluates the risk vs return profile for Apple and Samsung using their respective datasets. The risk is represented by the standard deviation of daily returns, while the return is represented by the average of daily returns.

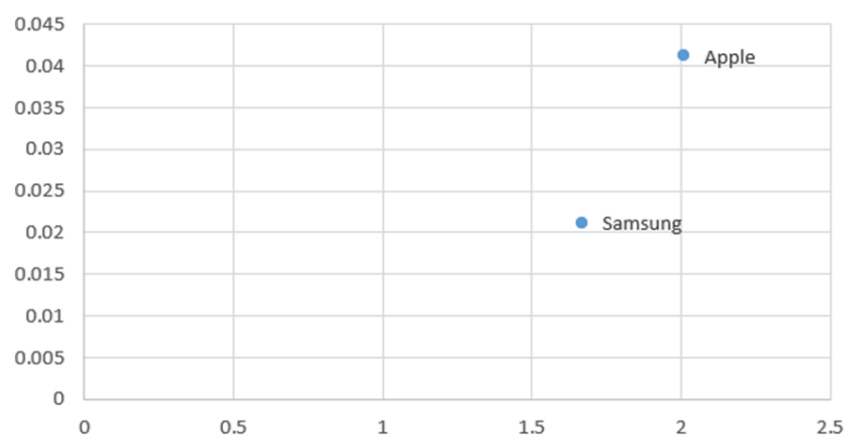


Fig. 6. Risk Vs Return Analysis

Referring to Fig. 6., it visualizes the risk vs return tradeoff for Apple and Samsung. Each point on the graph represents a company's performance, the X-axis represents the risk which is measured as the standard deviation of daily returns while the Y-axis shows the returns which are measured as the mean of daily returns. A higher position on the Y-axis suggests a higher average return, indicating Apple's stock performance is better than that of Samsung. A further position along the X-axis indicates higher risk, which shows Apple's stock price reflects greater volatility in returns. The tradeoff between risk and return can guide investors in deciding their preference based on risk tolerance. The risk amount can be inferred by calculating the standard deviation of daily returns. The average return is calculated from daily returns.

Company	Average Return	Risk
Apple	0.041213186	2.008051
Samsung	0.021174759	1.667068995

Fig 7: Values used for Risk vs Return Calculations

MARKET SENTIMENT:

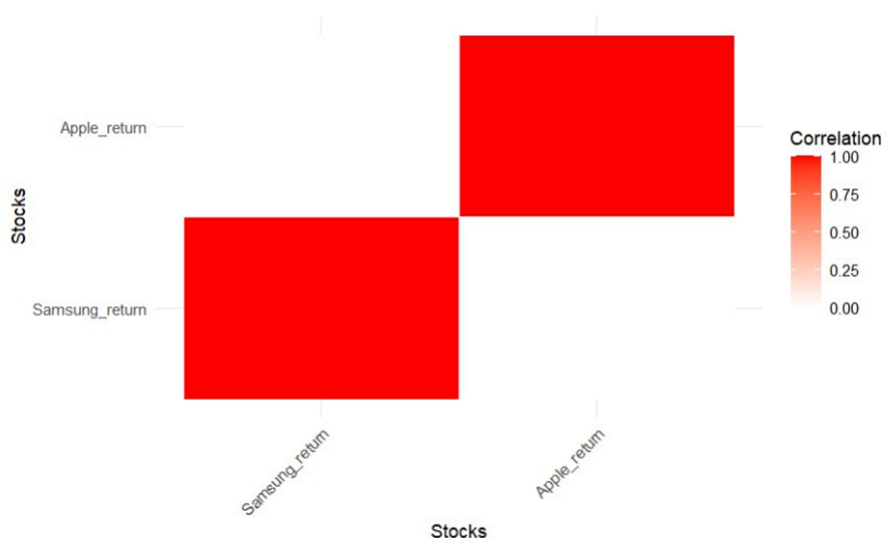


Fig. 8. Correlation Heatmap of Stock Returns

From Fig. 8, it can be inferred that the correlation between the returns of Apple and Samsung stocks is almost non-existent (correlation value of approximately 0.0056). This indicates that the stock returns of these two companies are practically uncorrelated, meaning movements in the returns of one do not have a linear relationship with the other.

CONFIDENCE INTERVAL AND HYPOTHESIS TESTING: EXCHANGE RATE AND SAMSUNG PRICE

The hypothesis is based on analyzing the average annual exchange rates of 24 years from 2000 to 2023 from the dataset [7] and the average adjusted close Samsung stock price from the dataset [3] [4]. Adjusted close price data was chosen because it is the close price after stock splits, dividends, and company-related buybacks.

Null Hypothesis (H_0): There is no significant correlation between exchange rate changes and Samsung stock price changes.

Alternative Hypothesis (H_1): There is a significant correlation between exchange rate changes and Samsung stock price changes.

1. Parameter of interest: $\mu_1 - \mu_2$
2. Null Hypothesis: $H_0 = \mu_1 - \mu_2 = 0$
3. Alternative Hypothesis: $H_a = \mu_1 - \mu_2 > 0$
4. Test statistic: $Z = (X_1 - X_2) / \sqrt{((\sigma_1^2 / n_1) + (\sigma_2^2 / n_2))}$
5. $n_1 = n_2 = 6035$, $X_1 = 20.28$, $X_2 = 22072.93$, $\sigma_1^2 = 17.31$, $\sigma_2^2 = 19763.06$, $z = -85.15$
6. The equality in H_a implies that a single upper tail test is appropriate. The P-value corresponding to $z = -85.15$ is 0.000.
7. The P-value = 0.000 is less than 0.05; hence, we reject the null hypothesis and accept the alternative hypothesis.
8. 95% Confidence Interval: [-22560.27, -21545.03]

Given the z-value of -85.15 and a corresponding p-value of 0.000, the null hypothesis is rejected. This means that there is strong statistical evidence to support the idea that the mean exchange rate changes and Samsung stock price changes are significantly different, and this difference is not due to random chance.

Using a two-sample z-test, the calculated z-value is -85.15, which is extremely large in magnitude. The p-value is 0.000, which is less than the significance level of 0.05. Hence, we have strong evidence to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1).

The directionality of the alternative hypothesis suggests a significant correlation between exchange rate changes and Samsung stock price changes. Since we are rejecting the null hypothesis, we can confirm that fluctuations in exchange rates are strongly associated with changes in Samsung's stock prices.

CONFIDENCE INTERVAL AND HYPOTHESIS TESTING: AVERAGE DAILY RETURN

The hypothesis is based on analyzing the average daily returns of Apple's stock prices from the dataset [1] [2] and the average daily returns of Samsung's stock price from the dataset [3] [4].

Null Hypothesis (H_0): The average daily return of Apple's stock is equal to Samsung's.

Alternative Hypothesis (H_1): The average daily return of Apple's stock is significantly higher than Samsung's.

1. Parameter of interest: $\mu_1 - \mu_2$
2. Null Hypothesis: $H_0 = \mu_1 - \mu_2 = 0$
3. Alternative Hypothesis: $H_a = \mu_1 - \mu_2 > 0$
4. Test statistic: $Z = (X_1 - X_2) / \sqrt{((\sigma_1^2 / n_1) + (\sigma_2^2 / n_2))}$
5. $n_1 = n_2 = 6035$, $X_1 = 0.0412$, $X_2 = 0.0212$, $\sigma_1^2 = 2.0082$, $\sigma_2^2 = 1.6672$, $z = 0.5964$
6. The equality in H_a implies that a single upper tail test is appropriate. The P-value corresponding to $z = 0.5964$ is 0.5509.
7. The P-value = 0.5509 is greater than 0.05; hence, we fail to reject the null hypothesis.
8. 95% Confidence Interval: [-0.0458, 0.0859]

Given the z-value of 0.5964 and the corresponding p-value of 0.5509, which is greater than the significance level of 0.05, we fail to reject the null hypothesis (H_0). This indicates that there is insufficient statistical evidence to conclude that the average daily return of Apple's stock is significantly higher than Samsung's. The observed difference in daily returns between the two companies is likely due to random variation.

Using a two-sample z-test for the alternative hypothesis (H_1), the p-value remains larger than the significance level, further supporting the null hypothesis. The confidence interval for the difference in means is [-0.0458, 0.0859], which includes 0, suggesting no significant deviation. Thus, we cannot claim that Apple's average daily return is systematically higher than Samsung's based on this data.

In conclusion, the data does not provide enough evidence to reject the null hypothesis that the average daily return of Apple's stock is equal to Samsung's. While Apple's mean daily return is slightly higher, the difference is not statistically significant. Therefore, we cannot confirm that Apple's stock consistently outperforms Samsung's in terms of average daily returns.

CONFIDENCE INTERVAL AND HYPOTHESIS TESTING: SAMSUNG IS BETTER STOCK

The hypothesis is based on analyzing the adjusted closing price of Apple's stock from the dataset [1] [2] and the adjusted closing price of Samsung stock from the dataset [3] [4].

Null hypothesis (H_0): Samsung is better or equal.

Alternative hypothesis (H_a): Samsung is worse than Apple.

1. Parameter of interest: $\mu_1 - \mu_2$
2. Null Hypothesis: $H_0 = \mu_1 - \mu_2 = 0$
3. Alternative Hypothesis: $H_a = \mu_1 - \mu_2 > 0$
4. Test statistic: $Z = (X_1 - X_2) / \sqrt{((\sigma_1^2 / n_1) + (\sigma_2^2 / n_2))}$
5. $n_1 = n_2 = 6035$, $X_1 = 34.44$, $X_2 = 20.38$, $\sigma_1^2 = 50.68$, $\sigma_2^2 = 17.43$, $z = 20.38$
6. The equality in H_a implies that a single upper tail test is appropriate. The P-value corresponding to $z = 20.38$ is 0.000.
7. The P-value = 0.000 is less than 0.05; hence, we reject the null hypothesis and accept the alternative hypothesis.
8. 95% Confidence Interval: [12.71, 15.41]

Given the z-value of 20.38 and a corresponding one-tailed p-value of 0.0, which is less than the significance level of 0.05, we reject the null hypothesis (H_0). This indicates that there is strong statistical evidence to support the alternative hypothesis (H_1): Samsung's adjusted close prices are significantly worse than Apple's.

The confidence interval for the difference in means is [12.71, 15.41], which does not include 0. This further supports the claim that the adjusted close prices of Apple are systematically higher than those of Samsung. The observed difference between the two means is statistically significant and unlikely to have occurred due to random chance.

In conclusion, the analysis provides strong evidence to confirm that Apple's adjusted close prices are, on average, significantly higher than Samsung's. This result supports the assertion that Apple outperforms Samsung in terms of adjusted close price metrics over the observed period.

RESULTS:

Apple's stock prices demonstrate higher variability and growth, reflected in broader ranges and higher medians. Samsung's stock prices are more stable, with lower variability and fewer outliers.

Apple exhibited exponential growth post-2012 due to innovative products and market expansion, peaking during COVID-19. Samsung showed steady growth with notable peaks in 2017 and 2021, attributed to key business milestones.

Apple's higher standard deviation indicates greater volatility but also higher average returns. Samsung offers more predictable returns, appealing to risk-averse investors. Inflation impacts Apple's stock more significantly than Samsung's. Exchange rate fluctuations introduce currency risk for Samsung, especially when converted from KRW to USD.

Null hypothesis for exchange rate and stock price correlation was rejected, confirming a significant relationship. Apple's adjusted close prices are significantly higher than Samsung's, validating Apple's stronger market performance. A negligible correlation between Apple and Samsung stock returns indicates independent stock movement.

CONCLUSION:

The comparative analysis over 24 years brings out distinct investment profiles:

- Apple: Higher returns with higher volatility, suitable for risk-tolerant investors.
- Samsung: Stable performance with less risk, attracting conservative investors.

Macroeconomic factors include inflation and exchange rates, which are important in stock performance. Apple's sensitivity to market conditions and Samsung's stability showcase diverse investment opportunities.

The comparative analysis, therefore, points to the understanding of an individual's investment goals in the choice between high-growth, yet volatile stocks like Apple and stable performers like Samsung. While investors seeking aggressive portfolio growth would probably prefer Apple because of its higher returns, Samsung is ideal for those investors who believe in consistency with lower-risk exposure. The findings also highlight how macroeconomic factors and geopolitical events intricately influence stock behavior, emphasizing the need for investors to stay informed about global developments.

LIMITATIONS:

1. Limited to 24 years; additional data could enhance long-term insights. Inflation and exchange rates are averaged annually, which might oversimplify their dynamic impacts.
2. Omitted detailed geopolitical and socio-economic factors influencing stock performance.
3. Conversion of Samsung's stock prices from KRW to USD may introduce approximation errors due to fluctuating exchange rates.
4. Sentiment analysis was limited to correlation matrices; incorporating real-time sentiment data might improve accuracy.

PROPOSED NEXT STEPS:

1. Include data from additional companies and industries for a more comprehensive market analysis. Incorporate quarterly or monthly inflation and exchange rate data for finer granularity.
2. Utilize AI and machine learning models for predictive stock performance analysis based on macroeconomic indicators.
3. Implement systems to analyze live stock market data, geopolitical events, and sentiment for real-time insights.
4. Explore alternative risk-return metrics beyond the Sharpe ratio, such as the Sortino ratio or beta analysis.
5. Develop visualization tools for dynamic comparisons of risk, return, and macroeconomic influences.

COLLABORATION:

<u>TEAM MEMBERS</u>	<u>CONTRIBUTION</u>	<u>SIGNATURE</u>
Abhinav Tyagi	Problem identification, Data Collection, Project goals, Data Visualization	
Venkat Abhijeet Chinnari	Project Goals, Data Cleaning, Bibliography, Data Visualization, Hypothesis Testing	
Manjari Gupta	Project goals, Data Analysis, Data Visualization, Bibliography, Report Formatting	
Naveen N.N.M.	Appendix, Problem statement, R-Programming, Report Formatting, Data Visualization	
Rishiraj Budhaale	Problem identification, Appendix, Problem Statement, Report Formatting	
Saheel Chavan	Problem identification, Data collection, Data Cleaning, R-Programming	

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We the team members,

Abhinav Tyagi, Venkat Abhijeet Chinnari

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Rishiraj Budhaale, Saheel Chavan

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APPENDIX:

Appendix A: Scatter Plot for the Opening vs Closing prices of both Apple and Samsung:

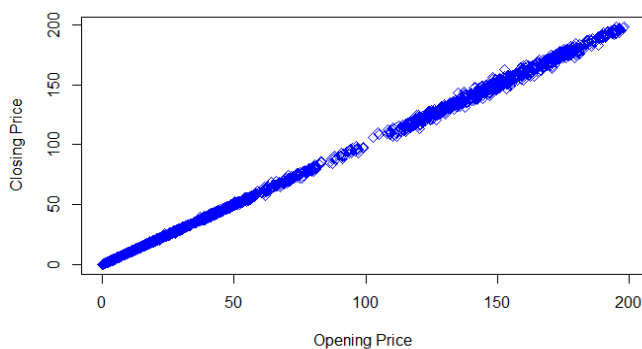


Fig 9: Apple's Closing vs Opening Prices

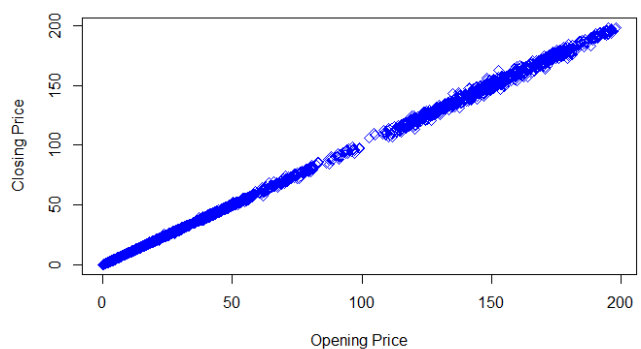


Fig 10: Samsung's Closing vs Opening Prices

In Fig. 9, the scatter plot depicts a positive correlation between Opening and Closing prices, reflecting consistent linear growth. Apple, with a higher mean and median in prices and a higher standard deviation, reflects higher stock value and variability, thus appealing to risk-tolerant investors seeking high growth.

Likewise, in Fig. 10, there is a positive correlation between Opening and Closing prices, but with a lower mean, median, and standard deviation than Apple. From the scatter plot, we can also observe a smaller range and less variability in Samsung. This indicates a more stable stock that appeals to more conservative investors.

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