Investment in Stocks of Cell Phone Manufacturers

- Reviewing past five years trade data

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The Problem

Problem

Company needs to find which company to advise their clients to invest in based on the data compiled.

Context

- Reviewing the past 5 years data
- Compare three cell phone manufacturing companies

Questions

- What is the Net income of each company?
- What are the Stock market upward/downward trends: adjusted close, percent change/day, probability of gains, mean percent change?

Companies in consideration:

- Apple
- Motorola
- Google (A and C)

*Google represented twice on the stock data

*This data is based on company as whole

Solution:

Invest in company with largest growth and profits from previous approximately five years.

We will analyze the data and choose to invest in the company with the greatest amount in profits and ideally the one that had the greatest increase in growth of stocks in the past 5 years.

*will have to reconsider once data is evaluated if these do not end up being the same company

Step 1: Retrieving Data

Where and How did you find the Data?

- We needed historical data for stocks of interest (Apple, Motorola, Googl (class A), Goog (class C)
- Considered several API sources
- Chose Alphavantage. It provides free Stock APIs and JSON for stocks
- Got 5 years of historical data for our stocks

Step 1: Retrieving Data

How did we create API keys and csv files?

- We signed on to Alphavantage.co and created an api key
- Received JSON for each stock symbol (APPL, MSI, GOOGL, GOOG)
- Lots of stock data in the CSV file

Step 1: Processing Data

Data Exploration and Cleanup?

- Formatted/beautified the data for better readability
- Made a data frame out of the dictionary for each stock symbol
- Our data of interest: Date, Open, High, Close, Adjusted Close, Volume, Dividends)
- Imported this data into plots.ipynb
- Created plots to visualize the data and analyze various statistical measures

Step 3: Data Analysis in Python

Jupyter Notebook work

Import Dependencies:

```
from api_keys import alpha_vantage_api_key

from datetime import datetime, timedelta

import print as pp

import pandas as pd

import requests

import matplotlib.pyplot as plt
```

	Date	Open	High	Close	Adjusted Close	Volume	Dividends
0	2018-05-10	187.740	190.37	190.04	45.288145	27989289.0	0.00
1	2018-05-11	189.490	190.06	188.59	45.116563	26212221.0	0.73
2	2018-05-14	189.010	189.53	188.15	45.011301	20778772.0	0.00
3	2018-05-15	186.780	187.07	186.44	44.602216	23695159.0	0.00
4	2018-05-16	186.070	188.46	188.18	45.018478	19183064.0	0.00
...	...	...	...	...	...	...	...

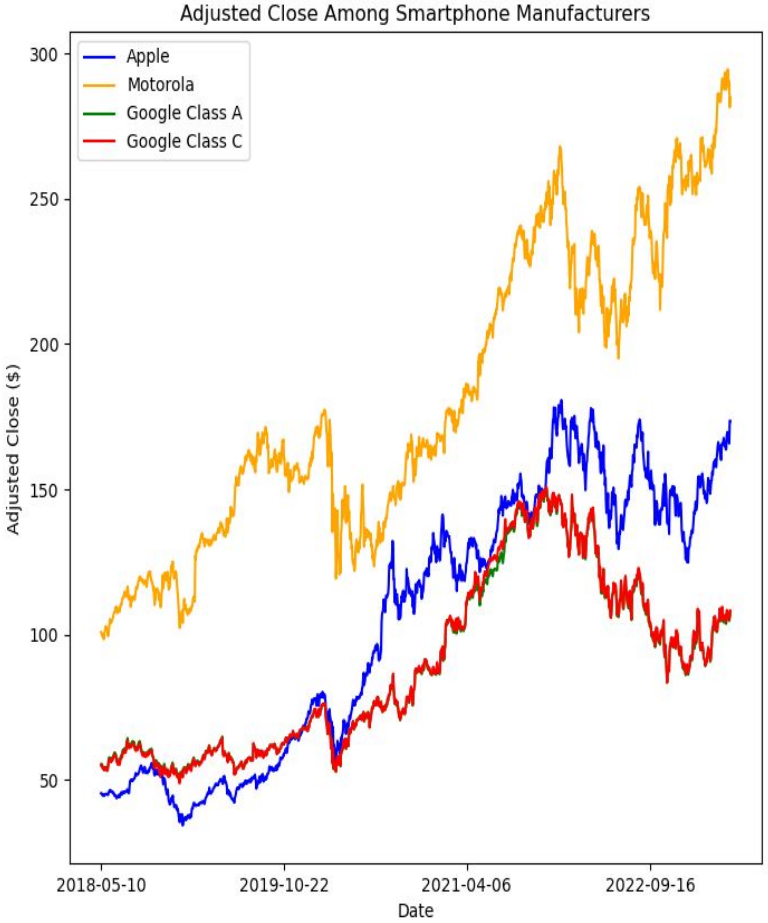
Step 4: Data Visualization

Line graphs: stock and net income data over time

Bar graphs: compare values

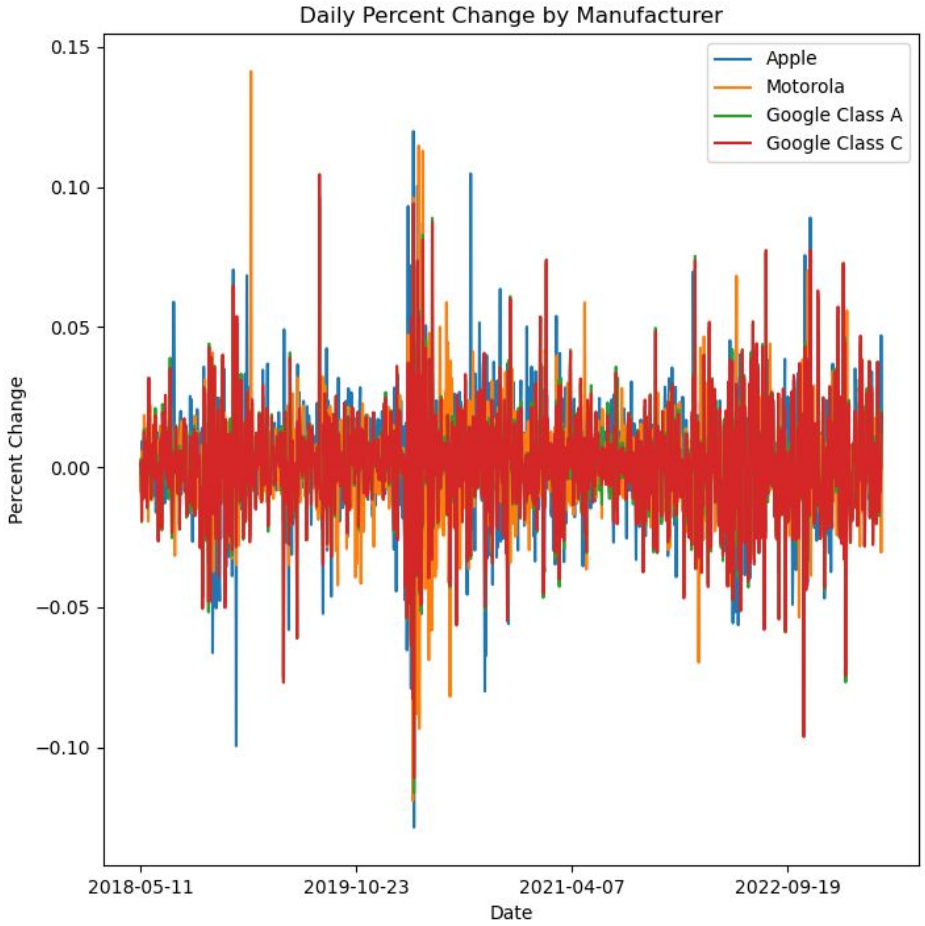
Histogram: one distribution of values

Daily Adjusted Close



Adjusted close is the closing price after adjustments for all applicable splits and dividend distributions.

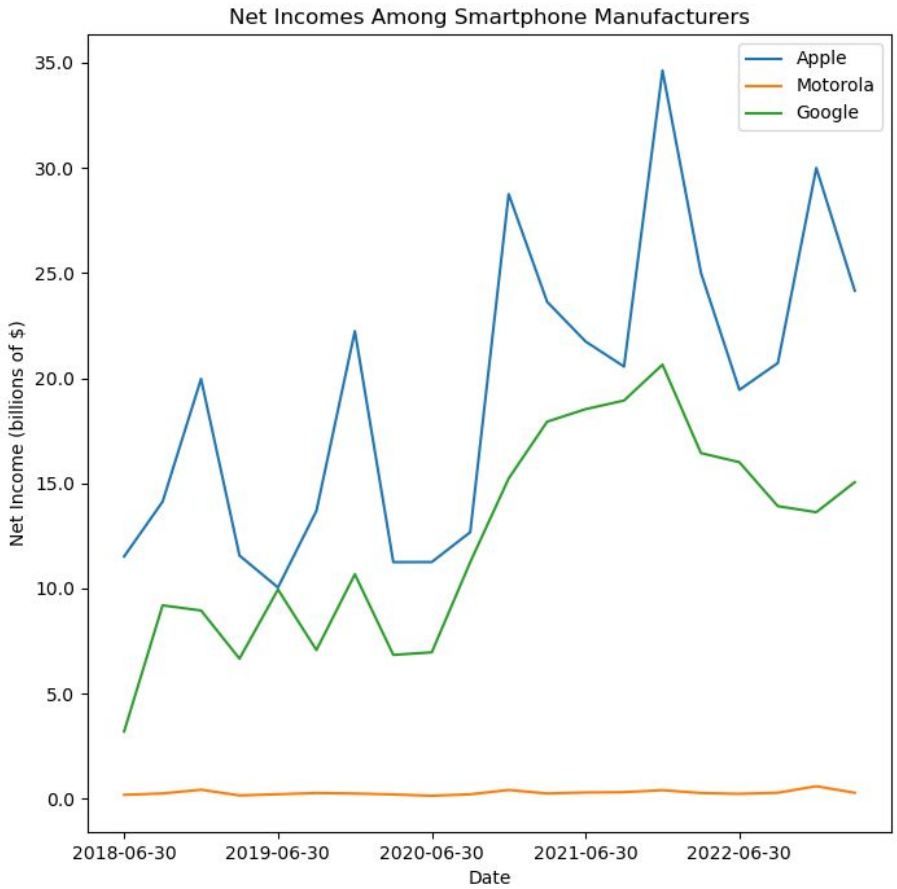
- Motorola always the highest
- Apple and Motorola have general upward trends



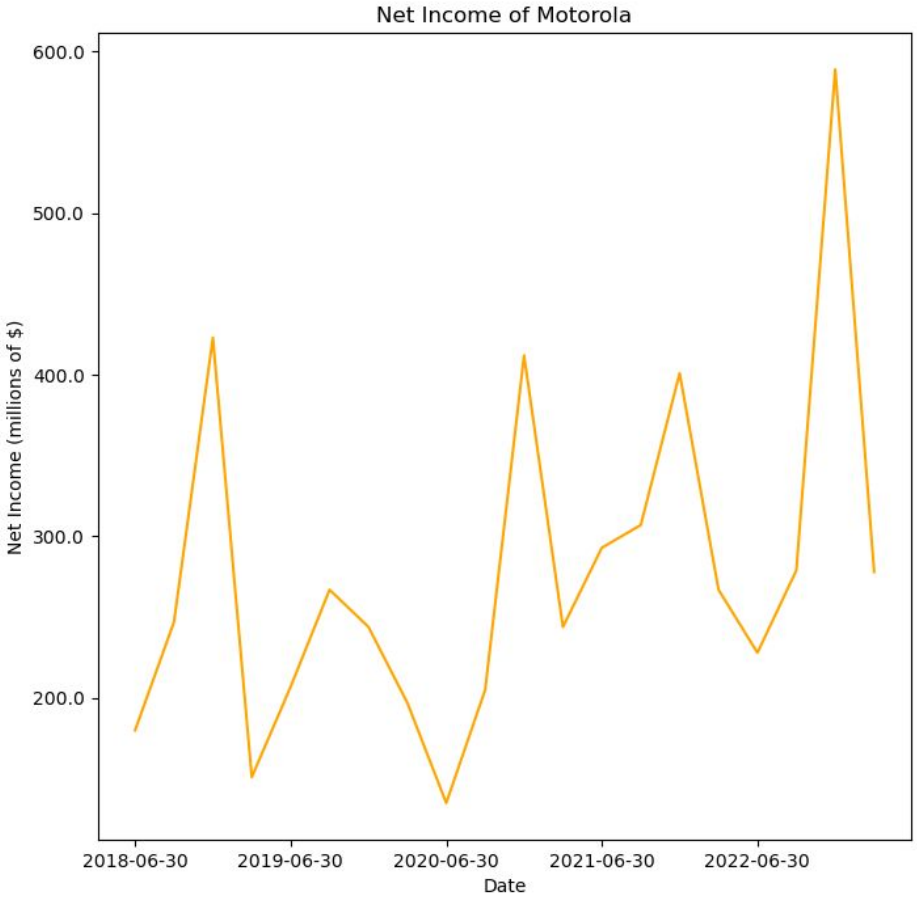
- This visualization presents our analysis of the daily percent change experienced by various manufacturing companies over a span of five years.
- In 2018, Motorola witnessed a significant increase in their daily percent change, whereas Apple observed a more substantial decrease.
- Daily percent change was in general chaotic, but Apple and Motorola had the biggest swings

Net Income:

Net income (NI), also called net earnings, is calculated as sales minus cost of goods sold, selling, general and administrative expenses, operating expenses, depreciation, interest, taxes, and other expenses.

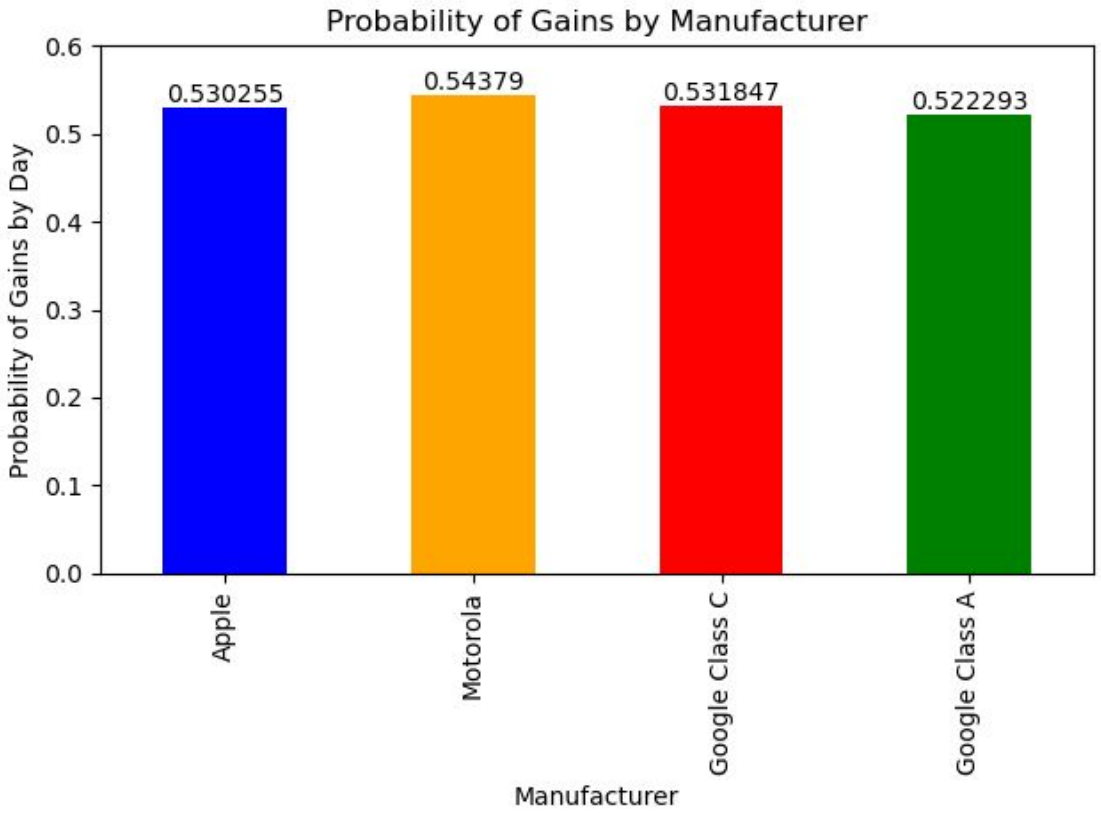


- Among the smartphone manufacturers, Apple has the highest net income
- Google has the second highest net income
- Motorola has the lowest net income
- Motorola appears more stable.



- Motorola appeared to be more stable, but with a different scale, we see it’s actually less stable
- This graph has a scale by millions of $, while the previous graph had a scale by the billions of $

Statistics



2 Sample Z Proportion Test

H_0: $p_1 = p_2$

H_a: $p_1 \neq p_2$

$\alpha = 0.05$

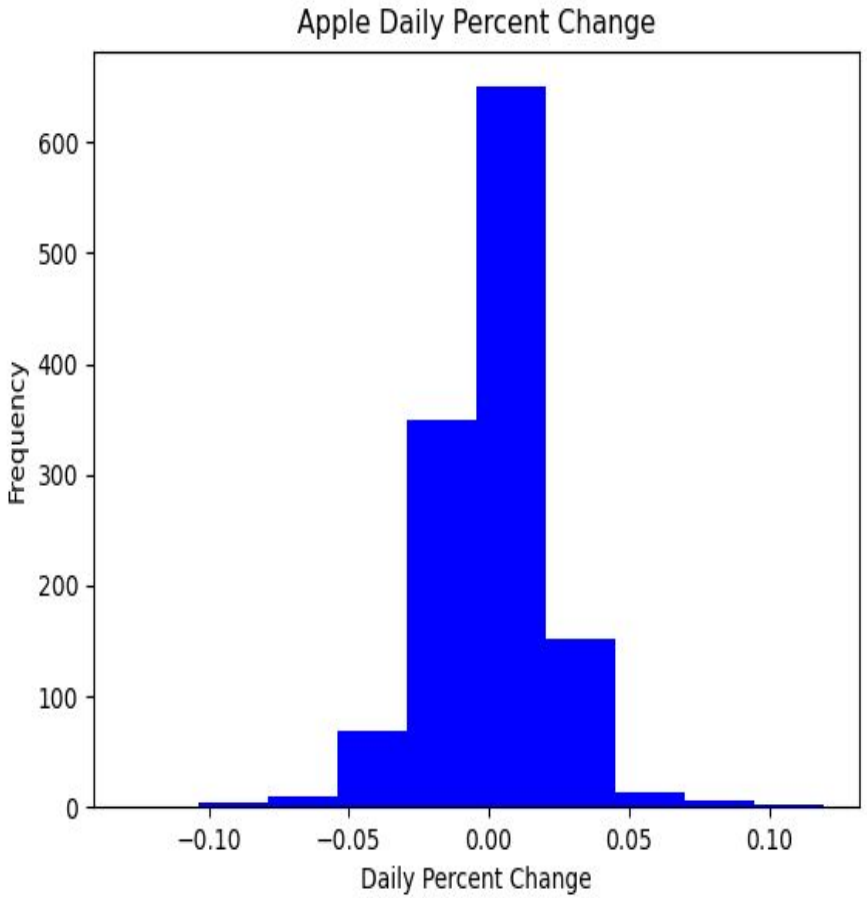
p_1: Apple

p_2: Google class A

Z = 1.08

P-value = 0.280

Fail to reject null, we cannot rule out random variation for observed differences.



Normality Test

H_0: Distribution is normal

H_a: Distribution is not normal

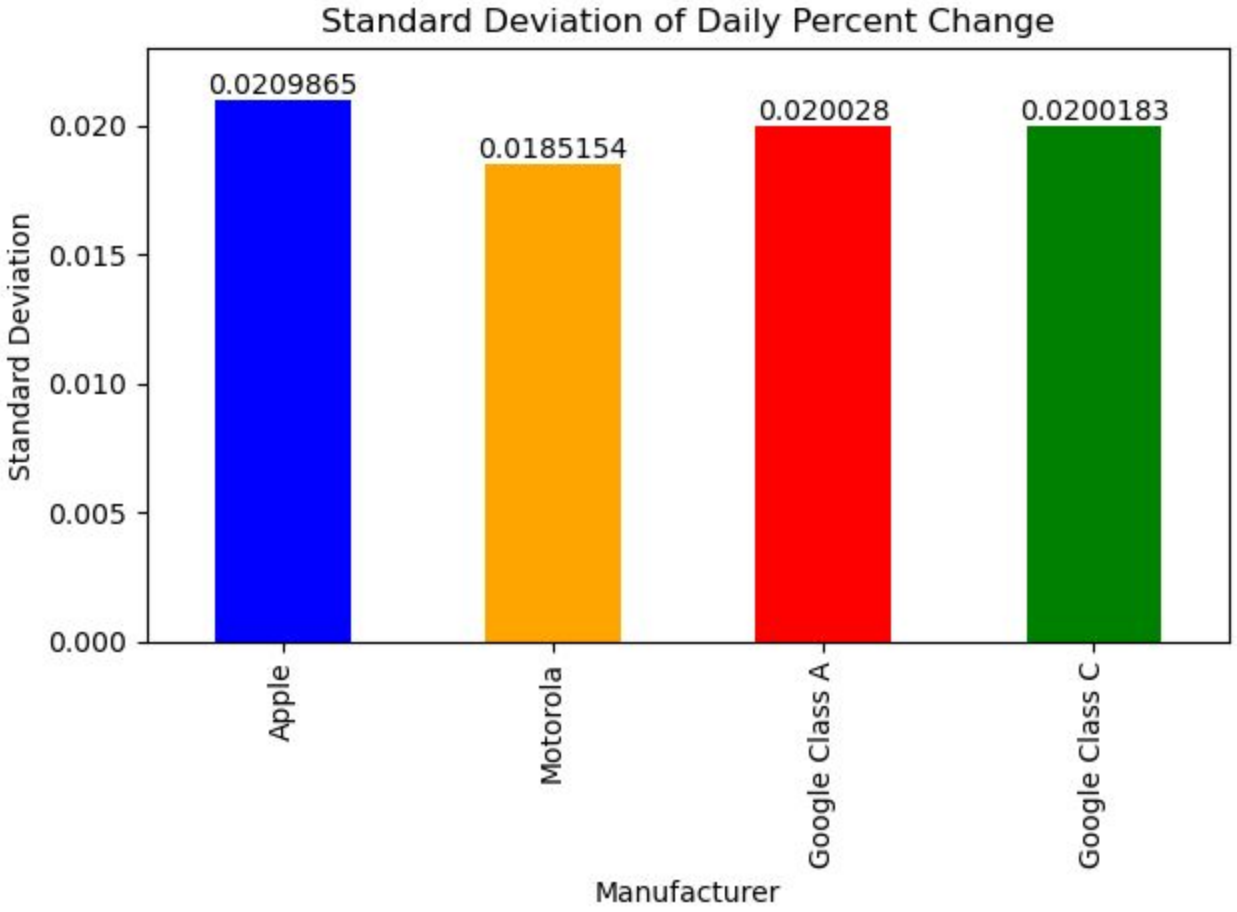
$\alpha = 0.05$

p-value: 2.87e-30

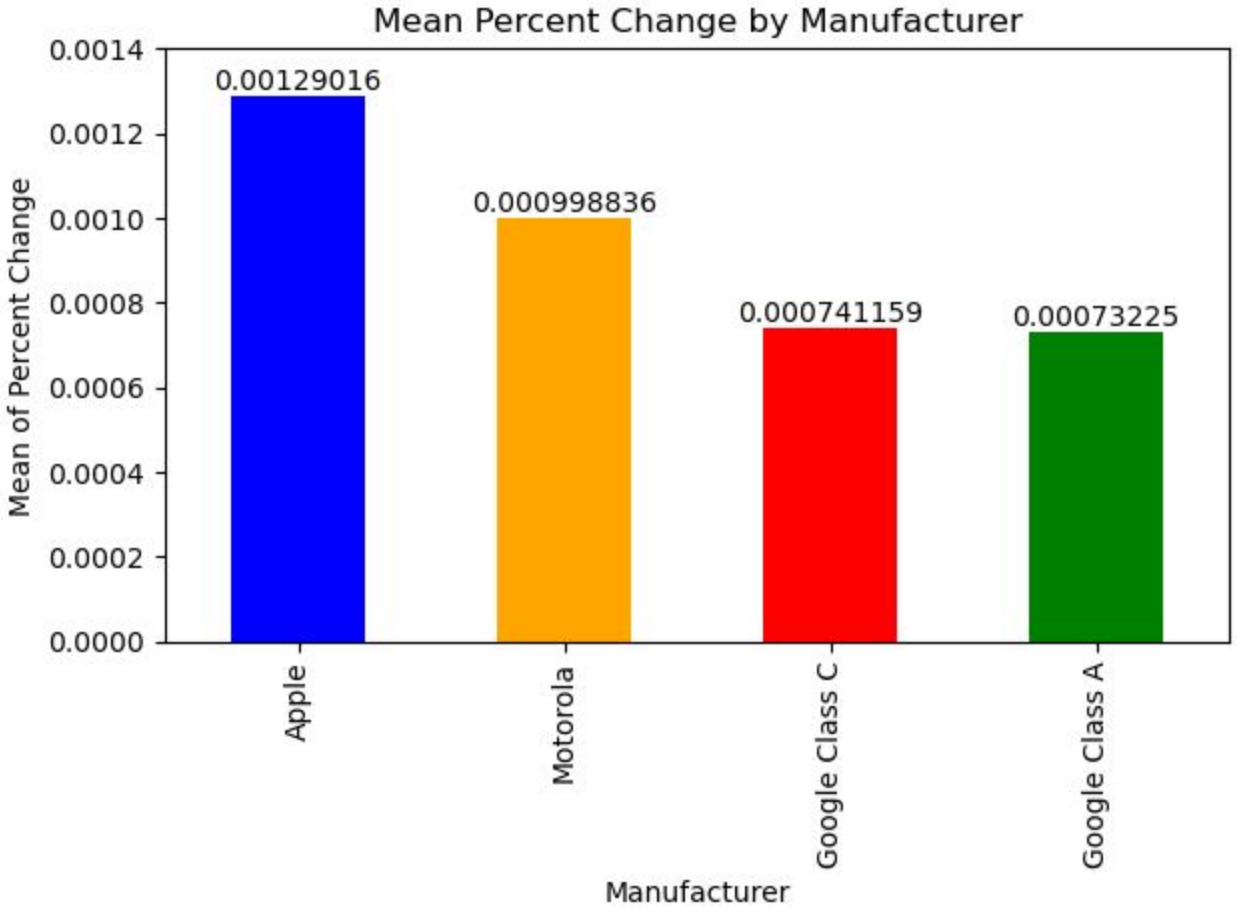
Reject null and conclude that the distribution is not normal.

Manufacturers	P-values
Apple	2.868617e-30
Motorola	7.854825e-47
Google Class A	9.281806e-25
Google Class C	1.051631e-25

All less than 0.05, so none are normal.



All are incredibly similar.



It appears that the means are different.

However, we did Mann Whitney U tests among all 6 combinations.

We chose this to test significance for distributions that are not normal.

Mann Whitney U tests

H_0: Distributions underlying the samples are the same

H_a: Distributions underlying the samples are not the same

$\alpha = 0.05$

Lowest p-value: 0.379

Fail to reject all the null hypotheses

Manufacturers	P-values
Apple and Motorola	0.649961
Apple and Google Class A	0.378540
Apple and Google Class C	0.389387
Motorola and Google Class C	0.628801
Motorola and Google Class A	0.612934
Google Class A and C	0.983079

Means and standard deviations are not statistically significantly different from each other

The question

Company

Company needs to make most profitable decisions on investments in order to satisfy clients.

Context

Reviewing the past 5 years data of three major smartphone manufacturing companies and comparing them will help us make the decision of which companies we should invest in on behalf of our clients.

Considerations

Need to take multiple factors into account such as the overall profits of the company and the trends in growth of stocks of each company.

Step 4: Conclusions

Which company should we direct our clients to invest in?

Based upon the data from the past 5 years, we should direct investments to Apple.

In conclusion, we would advise our hypothetical client to invest in the Apple stock because of the consistent growth in net income the company has experienced. The other data presented is not statistically significant enough to sway our decision towards another company.