Individual Assignment 1  
Apple Inc. Stock Price Visualization



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# 1.Executive Summary

This project report uses Python for data analysis and visualization and Tableau for interactive dashboards to investigate and visualize Apple Inc. (AAPL) stock values. From 2014 until 2023, the project will use time series analysis, technical indicators, and interactive visual exploration to find Apple stock performance trends, patterns, and anomalies. This study aims to assist investors, financial experts, and devotees understand AAPL's stock behavior and make judgments.

# 2. Introduction

## 2.1. Background

Apple is a technological colossus with a global influence. Apple's market dominance is explained by its complex effect on GAFAM equities (Google, Apple, Facebook, Amazon, Microsoft). From the viewpoint of investors and market experts, Apple's position is crucial, altering the environment in ways that reverberate across sectors. The volatility and patterns in its stock prices provide a fascinating glimpse at the impact of market forces, new releases, and global economic events on a premier technology business.

## 2.2. Problem Statement

Getting around the intricacies of the stock market may be quite difficult, especially when it comes to large-cap equities like Apple Inc. (AAPL), whose price is influenced by a variety of variables. This initiative focuses on two primary problems:

* **Understanding Apple's Stock Price Dynamics**: The price of AAPL fluctuates in response to a number of variables, such as news about the firm, market trends, and economic developments. A sophisticated method of data analysis is needed to identify the factors influencing price fluctuations.
* **Developing Financial Insights**: Investors with little analytical skills may struggle with managing the large amount of financial data. Tools that turn data into insights and make stock market research more accessible are required severely.

This study uses Tableau for interactive visuals and Python for deep analysis in an effort to address these problems. The goal is to make sense of AAPL's stock patterns from 2014 to 2023 and provide information to stakeholders so they may make informed decisions.

## 2.3. Objectives

This project uses Tableau for interactive visualization and Python for data analysis to provide an accessible but thorough examination of Apple Inc.'s stock performance from 2014 until 2023. Key objectives consist of:

* **Trend Analysis**: Over the given time frame, determine the major trends, patterns, and anomalies in Apple's stock values.
* **Impact Assessment**: Determine how Apple's stock has been affected by world events, new product releases, and changes in GAFAM stocks.
* **Technical Analysis**: To get a better understanding of stock behavior and possible investing opportunities, use technical indicators.
* **Interactive Visualization**: Build Tableau dashboards that let users customize their analysis and explore data in real-time.
* **Strategic Insights**: Using the data analysis, provide suggestions and actionable insights for analysts and investors.
* **Tool Demonstration**: Display how well Tableau and Python perform in the analysis and display of financial data.

These goals are set up to direct a targeted investigation that provides stakeholders with information on the dynamics of Apple's stock and aids in well-informed decision-making.

# 3. Data Preprocessing

## 3.1. Data Sources

The dataset for this project was sourced from Yahoo Finance, offering comprehensive historical stock price data for Apple Inc. (AAPL) spanning from 2014 to 2023. This period was chosen to capture a wide range of market activities, including product launches, financial announcements, and global economic events, providing a rich dataset for analysis.

The dataset consists of Apple Stock Price from January 2014 to December 2023. And the feature in the dataset is described by:

**Target**: Price trend for next day - Multi Class Classification

* bullish - If price increases more than 0.5%
* bearish - If price fall more than 0.5%
* neutral - If price movement stay with -0.5% to +0.5% range

Following technical indicators included:

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## 3.2. Data Preparation

**1. Data Cleaning**

* Handling Missing Values: The dataset has no null values, however the market is closed on weekends and holidays, causing date sequence gaps. Avoiding imputation and missing data ensures smoother time series analysis that makes trends and patterns simpler to spot.
* Duplicated Values: There are no duplicated records in the dataset.

**2. Feature Engineering**

* Feature Creation: Take advantages of the ‘date’ variable to create column ‘year’ which will help us visualize the stock price trending each year. Create the ‘Signal Line’ variable: The 9-day EMA of the MACD values, for the prediction analysis.
* Ensuring all data types were correctly formatted for analysis.
* The pandas’ module for Python served a key role in preprocessing, enabling effective manipulation and getting the dataset ready for further analysis.

# 4. Methodology

This research uses a combination of methods to examine the dynamics of Apple Inc.'s stock price over a ten-year period (2014–2023) by combining quantitative analysis with sophisticated data visualization. There are 2 main steps to the methodology:

1. **Python (Quantitative Analysis):**

* Data preprocessing: Cleaning and preparing the dataset using the pandas’ library, assuring the accuracy of the data by identifying any abnormalities, missing values. Creating more insightful attributes to make visualization process more straight-forward and easy to understand.
* Trend analysis: Examining underlying trends, seasonal patterns, and possible cyclical tendencies in the price of AAPL's stock by using time series analytic tools. Visualizing the correlation among continuous attributes and applying some of the python library like ‘plotly’ and ‘dataprep’ to visualize the volume and the price trending of the Apple Stock Price.

1. **Tableau (Interactive Visualization):**

* **Dashboard Creation**: Makes dynamic dashboards in Tableau that let you explore stock price data in a more engaging way. With these tools, you can look at different dates, fluctuations in prices, and technical indications simultaneously to get the complete picture.
* **Calculation of Technical Indicators:** Using Tableau, the analysis includes making pictures of important technical indicators like Moving Averages (MAs), Relative Strength Index (RSI), and Moving Average Convergence Divergence (MACD), etc. This change takes advantage of Tableau's ability to determine and display these factors in real time, which is very important for finding possible buy or sell signs and figuring out how the market responds.
* **Dashboard Creation:** Makes dynamic dashboards in Tableau that let you explore stock price data in a more engaging way. With these tools, you can look at different dates, fluctuations in prices, and technical indications simultaneously to get the complete picture.

# 5. Analysis and Findings

## 5.1. Python

**Analysis of Apple Inc. Stock Price and Volume**

The growing stock price and regular volume increases suggest that investors were more interested in upcoming products, earnings releases, and other key market events. Particularly, volume increases don't usually accompany price increases. This suggests that not all price movements result from significant purchasing. Figure 1

**Distribution Analysis of Stock Attributes**

By plotting the correlation of among different variables, we are shown how normal or skewed the price and volume metrics are spread out, along with technical measures such as RSI, CCI, and ATR. Figure 2

* Prices (Open, High, Low, and Close): The distributions here are probably right skewed, which is normal for stock prices that rise over time.
* Volume: The fact that the data is skewed toward the lower end could mean that days with a lot of transactions are less common but still important.
* RSI: If it were there, it would show how often the stock is thought to be too expensive or too cheap.
* The CCI and ATR show how prices change over time. When there is a lot of volatility, the gaps in the distributions are likely to be bigger.

**Correlation Heatmap**

The correlation heatmap provides insights into how different stock attributes relate to each other. For instance, since open, high, low, and close prices all move at the same time every day, you can expect them to have high ties. On the other hand, there may be weak or negative links between price and indicators like RSI or CCI if these indicators usually show a change in direction when prices hit a high point. Figure 3

**Stock Price Trends**

Using graph\_objects from plotly to compare Python dynamic visualization to tableau dashboard. The last line chart indicates stock price changes. Green indicates bullishness, red indicates bearishness. The graph demonstrates that bullish days are more common during uptrends and bearish days during downtrends or price stability. The data might be utilized to evaluate trend-following strategies or these positive and bearish categories' future predictions. Figure 4

## 5.2. Tableau

**Stock Price Chart (Closing, Opening, High, and Low)**

Price movements are likely attributable to market reactions to events since the trend is up. The chart's highs and lows may demonstrate how volatile the market is, particularly when firms have huge events, or the economy is terrible. Figure 5

**Volume Chart**

The bar charts reflect annual Apple stock trading volume on the volume chart. A reduction in transaction volume over the previous several years may indicate a less open market or fewer investors. Market reports, news, and other fundamental investigations are needed to determine the causes of this trend. Figure 6

**Moving Average Convergence/Divergence (MACD)**

MACD charts and Signal Lines predict market momentum and trend reversals. The Signal Line is usually a 9-day exponential moving average (EMA) of the MACD line, although traders may modify this period to suit their strategy or analytical requirements. MACD and Signal Line crossings on the chart may have indicated buy or sell. MACD crossing above the Signal Line is bullish, while crossing below is bearish. Figure 7

**Volume-RSI Overlay**

The overlay of RSI on a volume bar chart compares price momentum to trade volume. In general, an RSI over 70 indicates overbought situations and below 30 oversold ones. RSI values may correspond with larger trading volumes, suggesting stronger investor responses to perceived overbought or oversold circumstances. Figure 8

**RSI, Bollinger Bands**

Apple stock volatility and price levels are shown here. Bollinger Bands expand and shrink with volatility, and stock prices frequently return to the mean after hitting them. Overbought or oversold scenarios may be contextualized by simultaneous RSI measurements. Figure 9

**Average True Range and Volume**

This graphic shows trade volume and market volatility indicator ATR. The ATR may spike with intense market activity or events that generate large price shifts. Figure 10

**Simple Moving Average (SMA) Visualization**

Apple's closing stock price and 50-day SMA are shown on the SMA chart. SMA lines smooth out price swings to display the main trend, which in this example is a stock price rise throughout the given period. This shows a continuous growth in value, with the SMA identifying large stock price deviations. Figure 11

**Exponential Moving Average (EMA)**

With a 50-day Exponential Moving Average, the EMA chart shows the stock's closing price. The EMA is more sensitive to recent price fluctuations than the SMA, thus it may suggest price changes sooner. The EMA chart shows the stock staying above the moving average, signaling bullishness. Figure 12

**Insights**

These analyses allow us to understand:

* The stock of Apple Inc. has increased significantly throughout the course of the analysis.
* Significant trade volumes occur during periods of obvious high volatility, suggesting that the market is responding to events.
* Buying or selling choices may be informed by the insights provided by the MACD and Signal Line crossings, which indicate possible momentum changes.
* When paired with price and volume information, RSI levels provide a more complex picture of market emotion and possible overbought or oversold situations.
* SMA and EMA lines tracking the stock's price show a consistent trend with minimal dramatic changes, and crosses may be important for further research.

When these technical indicators are combined with Tableau visuals, the result is a thorough analysis of Apple's stock performance that may help investors make more informed decisions.

# 6. Discussion

The in-depth study shows that Apple's stock has been steadily going up, which fits with the company's growth story. The study examined adjustments, which could mean that the market is open to outside events and statements. Technical analysis can't explain changes in the market that were not expected or changes in the basic signs of financial health. You should use the MACD and RSI along with other market trends and research to get a better idea of how the market is acting. This study shows that dynamic screens with technical signs and easy-to-use visual tools may give even decision-makers who aren't good at analytics more power.

# 7. Conclusion

In conclusion, the research makes use of Tableau’s dynamic visualization and Python’s data manipulation to comprehend the fluctuations in Apple’s Stock price between 2014 and 2023. The study highlights how important it is to use a variety of data analysis and visualization tools in order to comprehend past performance and forecast future trends. Stakeholder decision-making has been enhanced by this research's tools, which transform unstructured data into a coherent narrative.

# 8. References

<https://fastercapital.com/content/Apple-s-Market-Dominance--How-it-Impacts-GAFAM-Stocks.html>

<https://plotly.com/python/time-series/>

<https://matplotlib.org/>

<https://www.kaggle.com/datasets/aspillai/apple-stock-price-prediction-10-years/data>

# 9. Appendix

## 9.1. Python

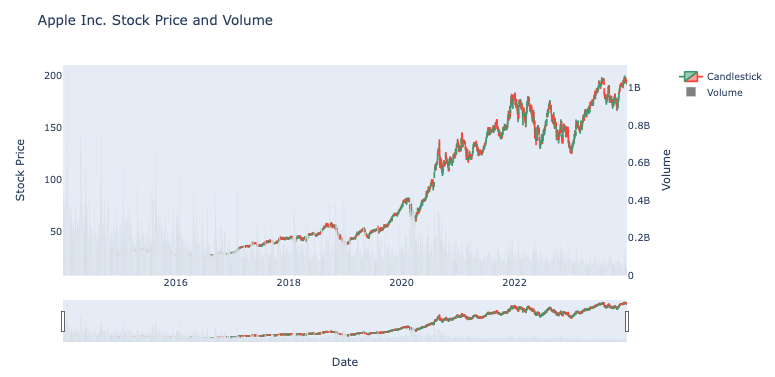


Figure 1

A screenshot of a graph

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Figure 2

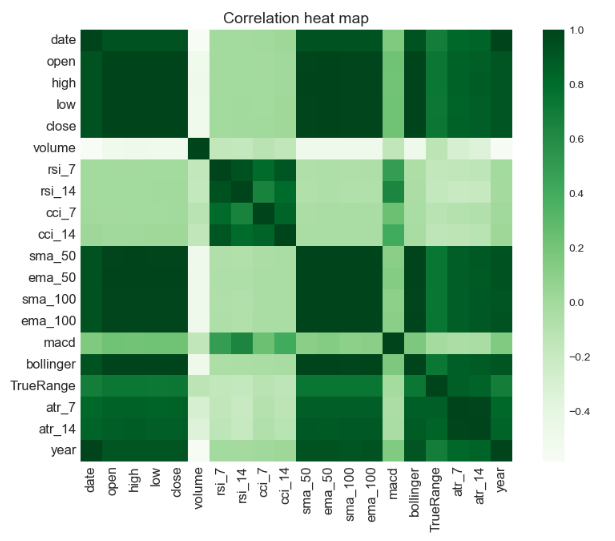


Figure 3

A graph with red and green lines

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Figure 4

## 9.2. Tableau

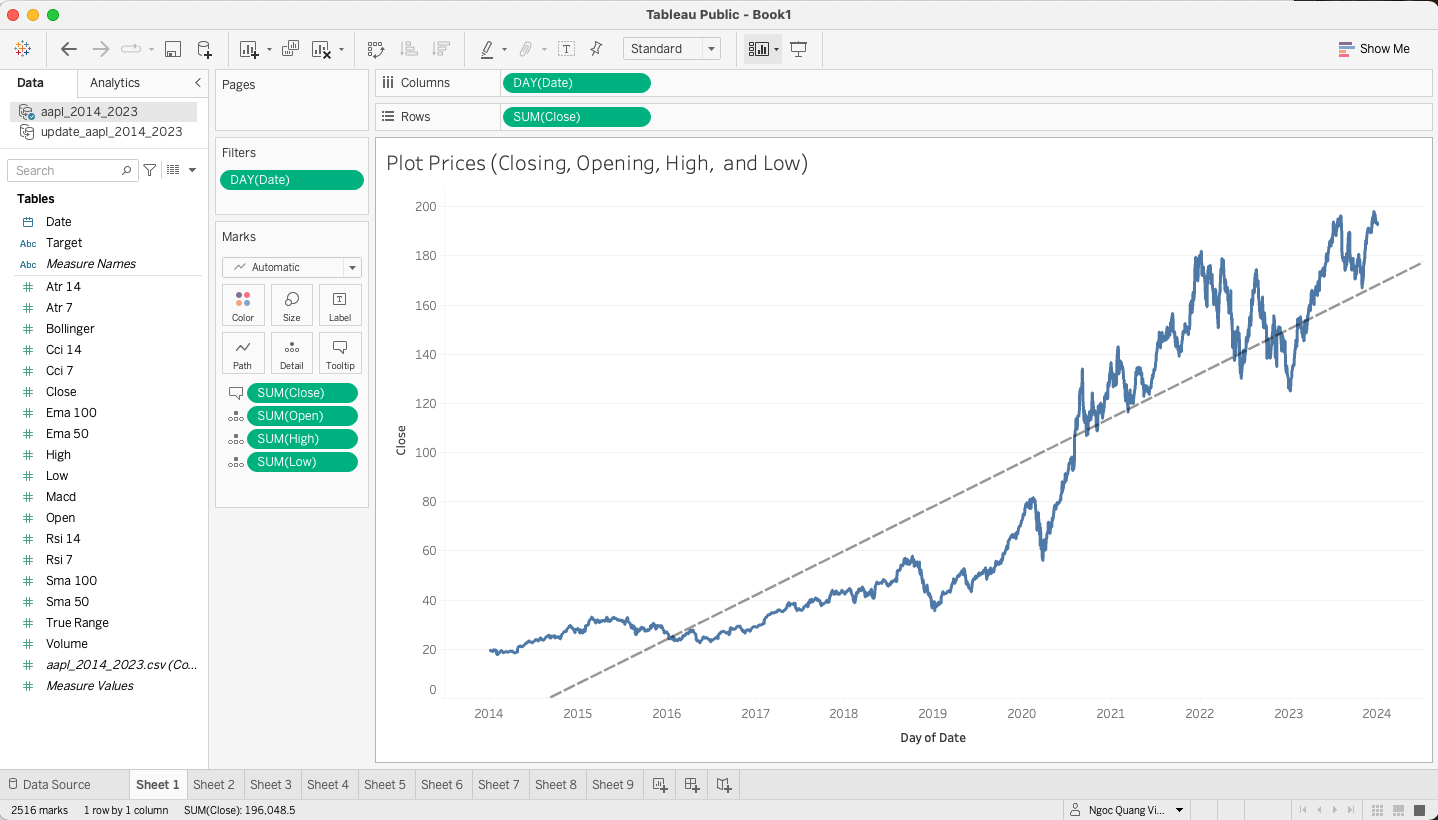


Figure 5

A screenshot of a graph

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Figure 6

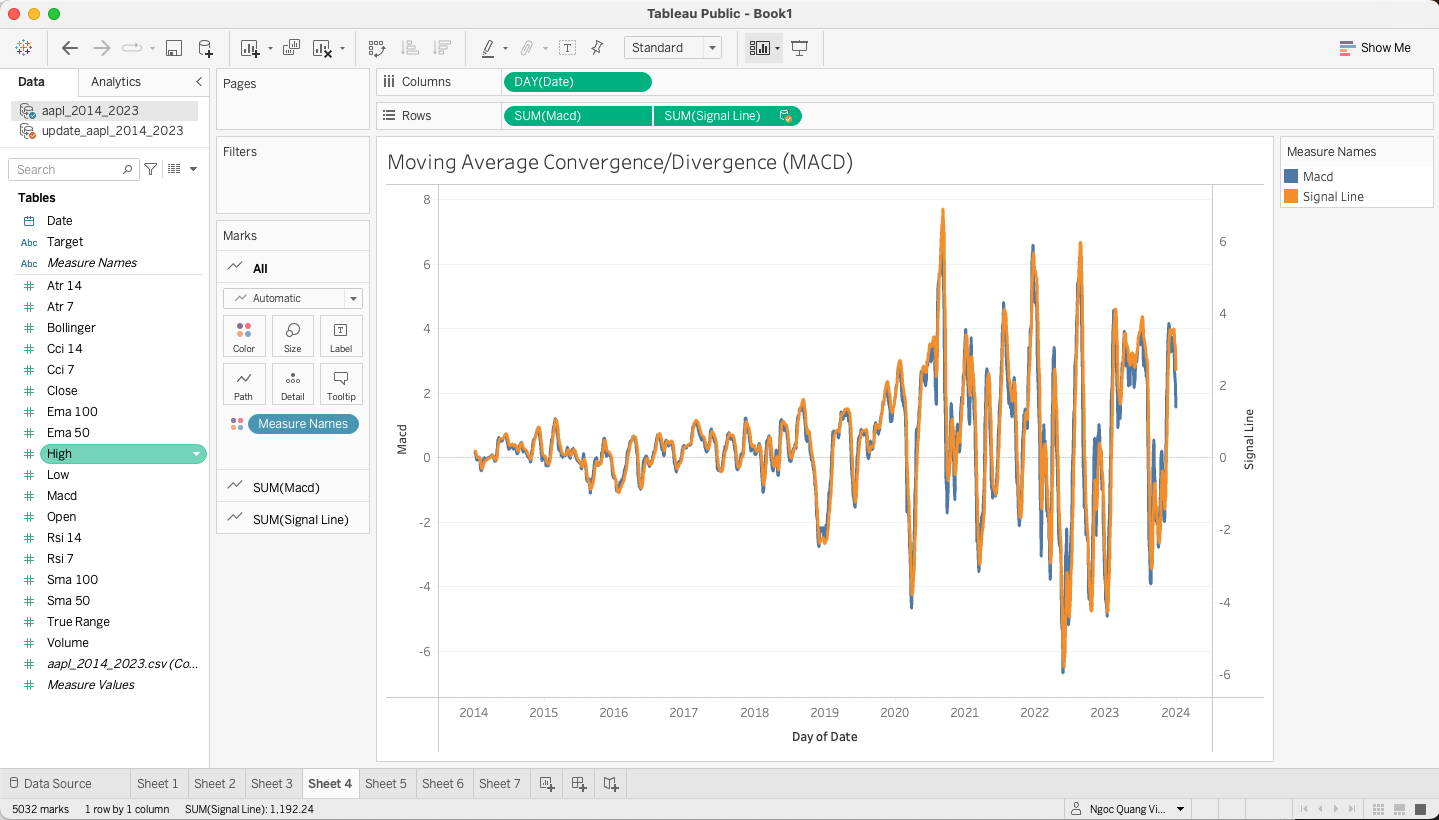


Figure 7

A screenshot of a graph

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Figure 8

A screen shot of a graph

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Figure 9

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Figure 10

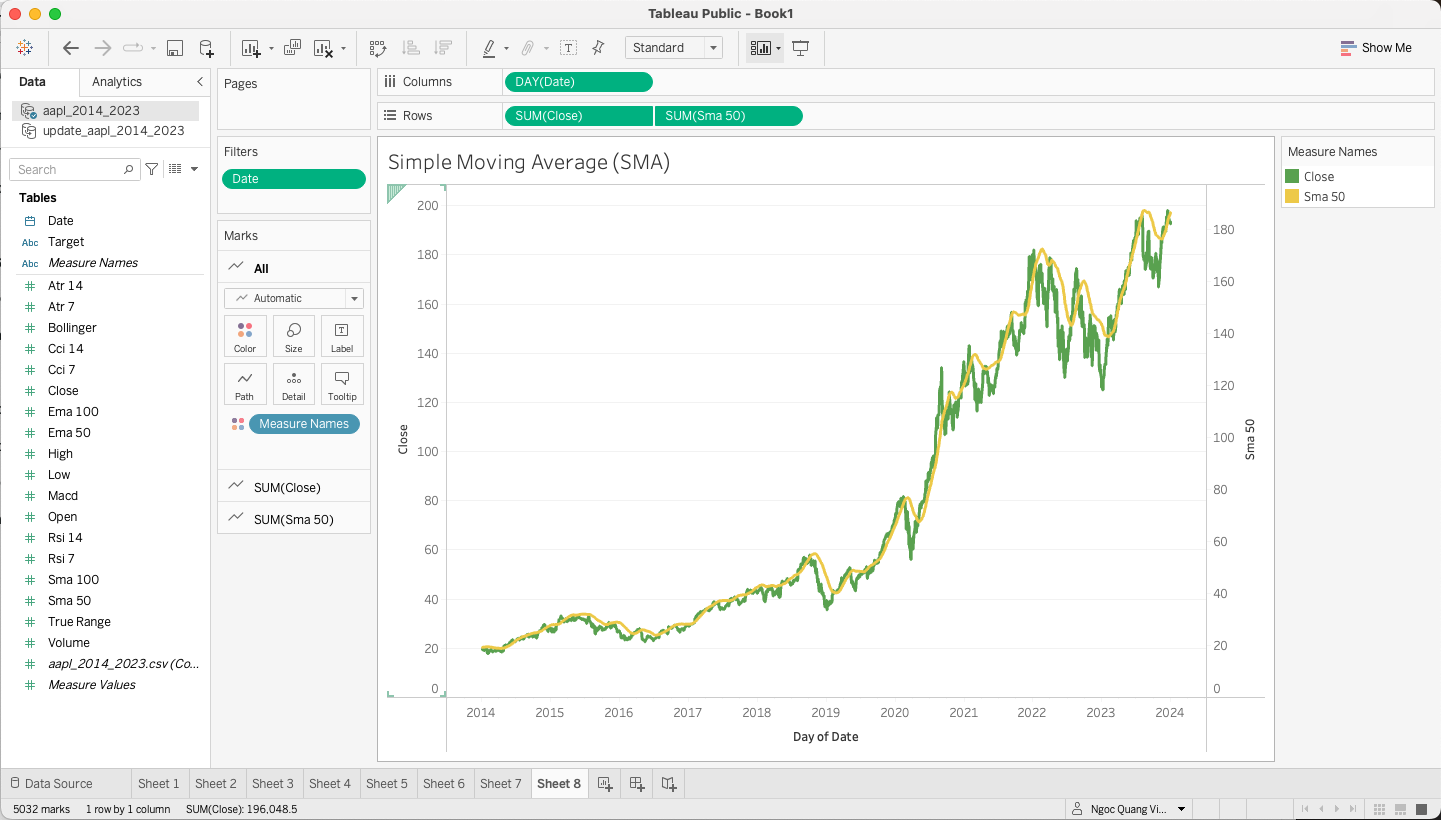


Figure 11

A screen shot of a graph

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Figure 12