

# Project milestone 1 Group 6

## Introduction

Stock market data has long since attracted the attention of numerous people, while the mere stock trend charts themselves provide little, if none at all, assistance in the analysis and understanding of stock market data. Our group have decided to construct a **design studio** on **stock market data visualization**. The studio is aimed to serve stock managers and potential stock buyers who need better interactive visualization that connects stock trends with multiple possible influencing factors.

The factors selected are **Political and International Influence, Company Factors, News and Events, Macro-economic variables**. And the questions we want to answer are: How can data visualization that combines stock data with each category of factors be implemented?

Therefore, the dataset(s) that we select will contain 2 parts: one main dataset which contains the stock information, and 4 ancillary datasets providing data on each factor. The datasets are appended at <https://github.com/kcui23/STAT679/tree/main/datasetExample>.

## Political and international Influence:

For the **political influence**, we mainly focus on the political networks. The chapter “Visualization of political networks” in book *<The Oxford Handbook of Political Networks>*[1] talks about the relationships between countries using bubbles and lines.

We'll try to achieve a graphic like the *figure 1.1* by using **D3**, which allows user to select a section of area and able to see the **zoom in graphic**. What's more, when users hover the mouse over a specific link, the corresponding stocks can be shown.

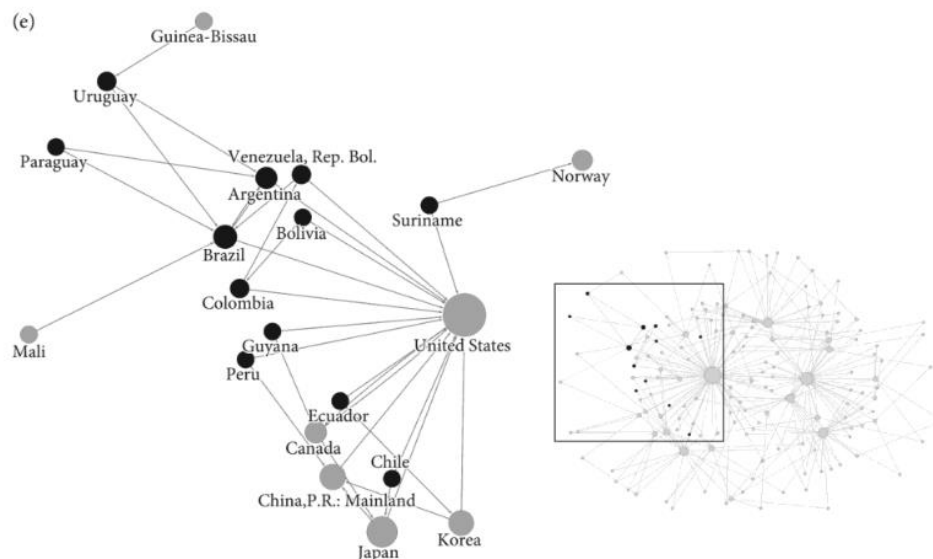


Figure 1.1 Focus/Context visualization of network

For the **international influence**, we mainly focus on the impact of exchange rate across nations on stock prices. L.Sui and L.Sun's paper[2] had talked about this topic thoroughly. The paper examines the dynamic relationships among local stock returns, foreign exchange rates, interest differentials, and U.S. S&P 500 returns. There are a few visualization means used in this paper, like line chart and facet map.

To combine this with our project, we're thinking using D3 to build an **interactive page** which shows relationship between stock prices and exchange rates. Also, we may use different data scheme to display the data in more detail.

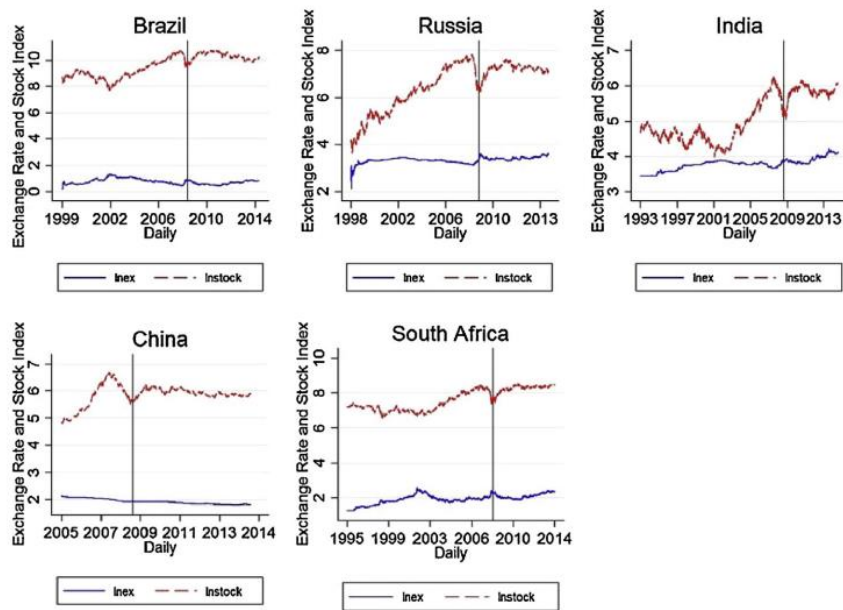
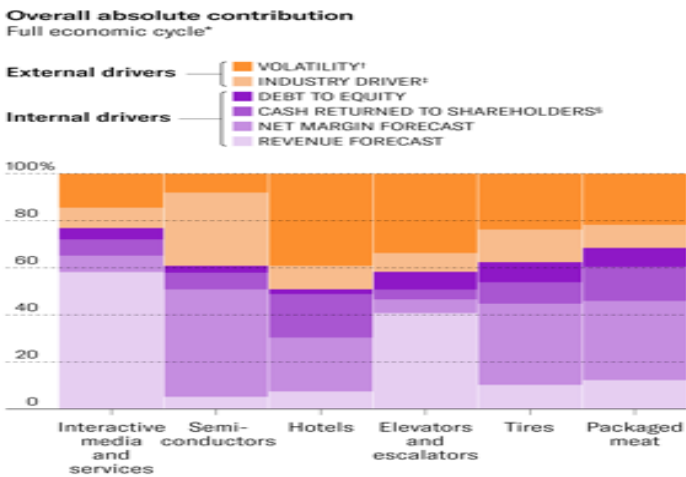


Figure 1.2 Exchange rate and local stock index in natural logarithm

# Company Factors

A company's **revenue** is definitely an important factor of its stock[3]. Thus, we plan to use the data visualization tool we have learned to create appropriate plot of a company's revenue. The visual idiom recur most frequently is a stack bar plot[4]. See *Figure 2.1*

Figure 2.1 Stack bar plot sample



We can use a **shiny app** to implement an **interactive stack bar**, to gather more information in one plot, elegantly and concisely.

What's more, the **manager and their policy** of a company can impact the company's revenue in a huge degree. In our mind, a good way to create a data visualization of this data is using an **interactive timeline**[5]. American Presidents timeline visualization is an example, as shown in *figure 2.2*.

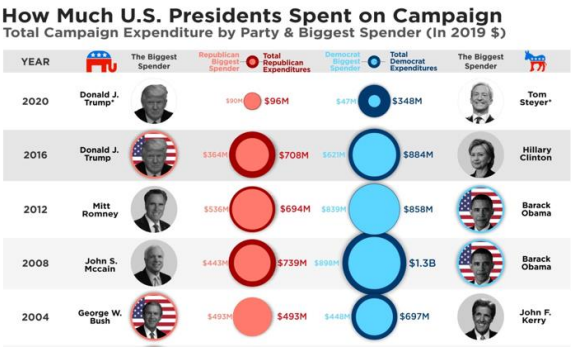


Figure 2.2 U.S. Presidents timeline visualization

For the reason that a company usually doesn't has such a long history as America, thus, instead of this non-interactive visualization, we could **use D3** to create an interactive transition timeline of a company's important roles, not only the CEO.

## News and Events

Specific occurrences such as product launches, mergers and acquisitions, insider trading, and more can significantly influence individual stock performance, yet there isn't an appropriately sophisticated visual representation available. The common practice among brokerage firms is to annotate special events on the stock candlestick chart timeline (as shown in *Figure 3.1*) or present them in a **separate module alongside** (as depicted in *Figure 3.2*).



Figure 3.1: Longbridge Securities stock trading interface, with special events marked on the timeline at the bottom.

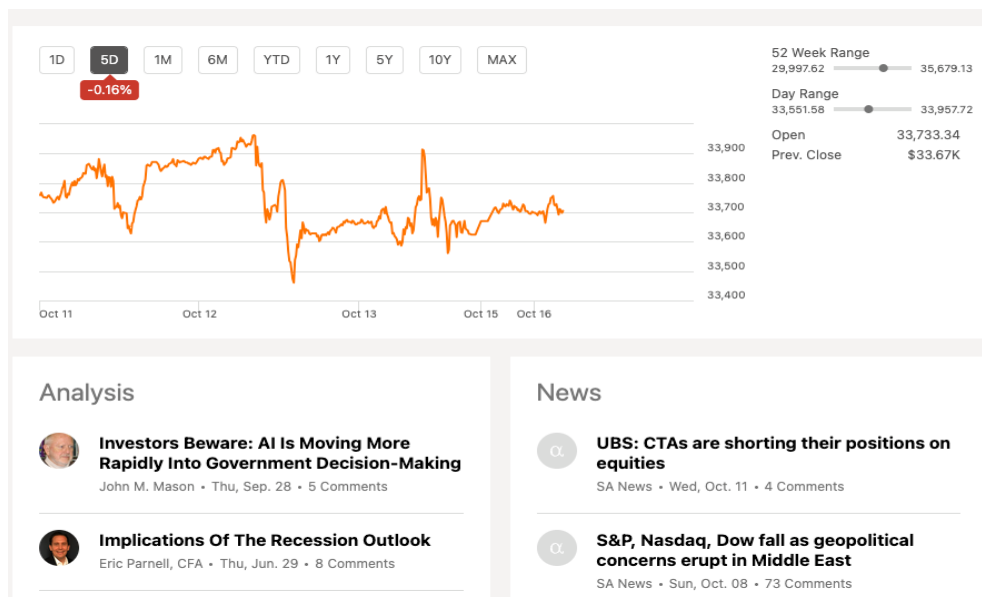
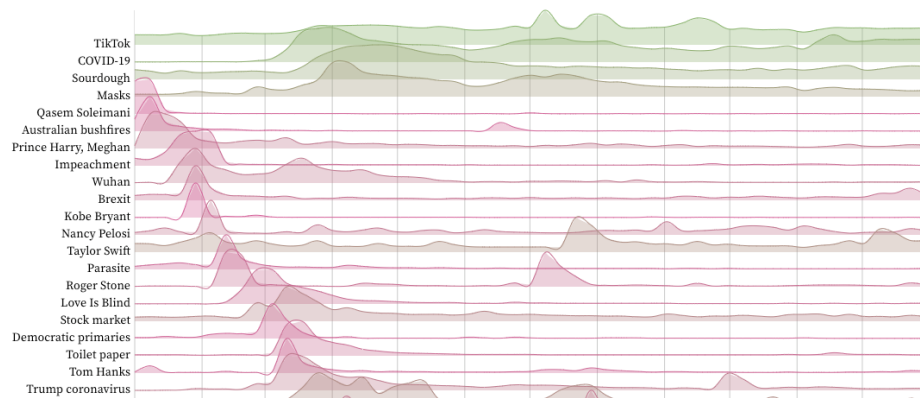


Figure 3.2: Seeking Alpha stock interface, with news and industry events displayed in text at the bottom right.

Merely listing facts doesn't aid in quick comprehension. Luckily, large language models allows us to achieve better results [6]. For textual messages such as news, an intuitive metric is **sentiment**, whether people are bullish or bearish. Displaying various news aspects may resemble a confusion matrix. Another quintessential example is the adjustment to the **VIX index**. Often referred to as the “fear index”, the VIX indicates the extent of short-term market volatility concerns. Previous research suggests that this classic index can be adjusted using news information[7]. This way, we have **both quantitative and qualitative indicators** at our

disposal. Classroom examples showcasing housing prices suggest that reactive components can be significantly beneficial in this context. Alternatively, we could endeavor to redesign classic visuals, as illustrated in *Figure 3.3*.



**Figure 3.3:** A potential visualization of news sentiment.

## Macro-economic variables

**Macro-economic variables** have garnered significant attention in stock market research, being recognized as major influencers of stock market trends. However, many existing visualizations tend to overlook these economic insights. One approach we're considering is to create interactive charts using tools like ggplot2 and a shiny app. These charts could overlay a company's stock price with key economic indicators like GDP growth, unemployment rates, and inflation. An example is shown in *Figure 4.1*.

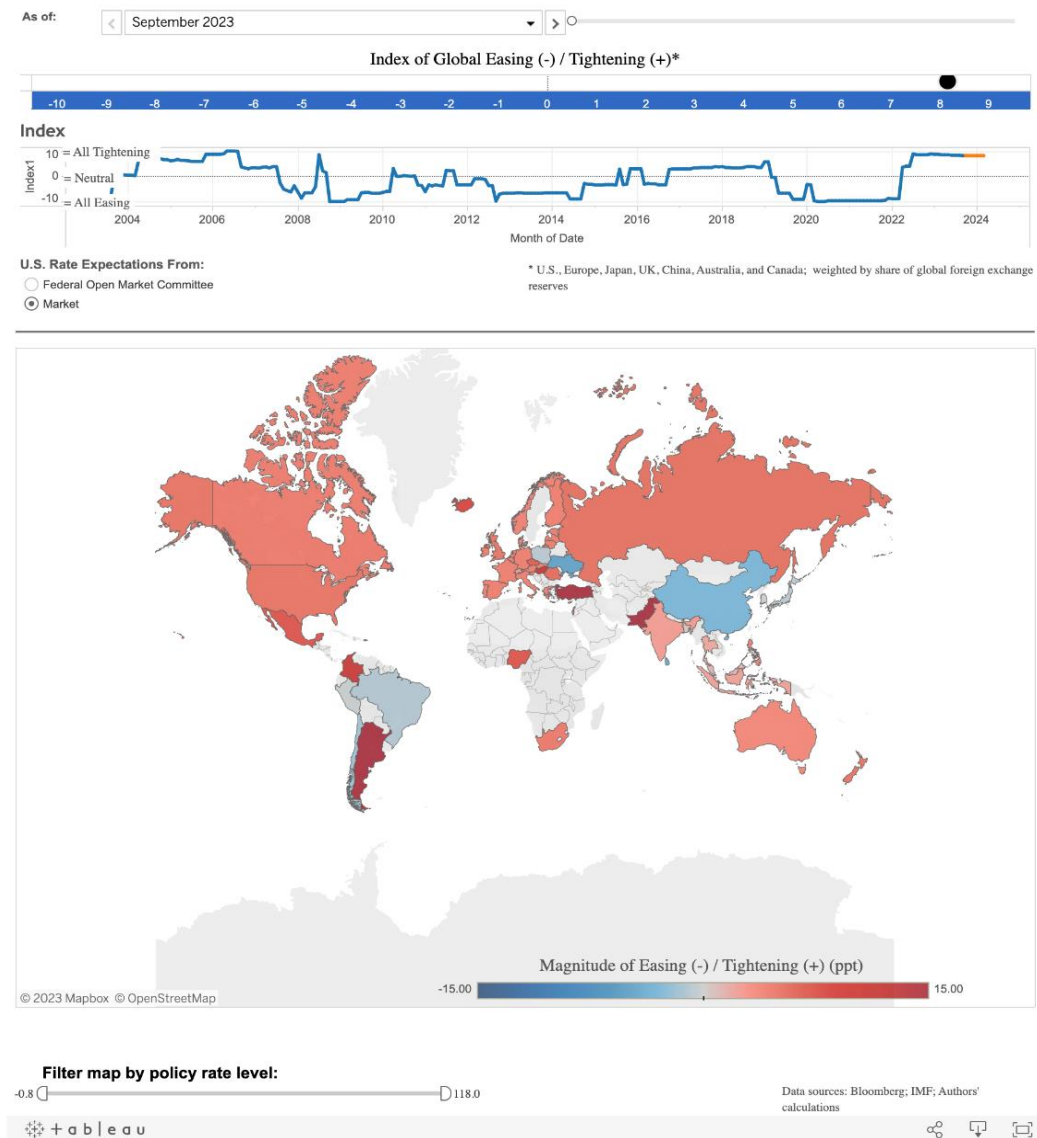


Figure 4.1 An Interactive graph on Macro-Economics Variables

In addition, we plan to **integrate multiple visualizations** to offer clients diverse references.

Recognizing the significant impact of **central bank policies** on the stock market[8], we also contemplate developing **event-driven visualizations**. These would provide a timeline

highlighting key policy decisions and their subsequent effects on stock market performance. Furthermore, we're exploring the use of heatmaps. The **heatmap** in *Figure 4.1* allows the reader to visualize the differences in fiscal policy over time and space.



## Summary

Our group want to study about stock data. We selected 4 major factors that we believe will greatly affect stock prices. Based on these assumptions, we searched for relevant papers and resources and decided to construct a design studio which combines the stock data with these factors in our data visualization. The data we use combines the main data of stock and 4 ancillary data. We choose to adopt some of the existing experience but try to make some improvement, using D3, shiny app and other knowledge from class in the process.

## Reference:

- [1] Victor, J. N., Montgomery, A. H., & Lubell, M. (Eds.). (2017). The Oxford handbook of political networks. Oxford University Press.
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- [3] Talluri, K. T., & Van Ryzin, G. J. (2012). Revenue management under a general discrete choice model of consumer behavior. *Management Science*, 58(1), 15-33.
- [4] Heer, J., Bostock, M., & Ogievetsky, V. (2010). A tour through the visualization zoo. *Communications of the ACM*, 53(6), 59-67.
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- [6] Lopez-Lira, A., & Tang, Y. (2023). Can chatgpt forecast stock price movements? return predictability and large language models. *arXiv preprint arXiv:2304.07619*.
- [7] Hagenau, M., Liebmann, M., & Neumann, D. (2013). Automated news reading: Stock price prediction based on financial news using context-capturing features. *Decision support systems*, 55(3), 685-697.
- [8] Emma3129. 2023. Global Monetary Policy Tracker. Tableau.  
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