MGT 6203 Group Project Proposal Template

**TEAM INFORMATION (1 point)**

**Team #: 011**

**Team Members:**

1. Thomas Byrne; thomascbyrne12

* Operations Analyst at Bank of America, B.S. in Mathematical Sciences from Clemson University

2. Liangqu Chen; Lchenbusiness

* Demand planning and production manager at Chinatex Corp. M.S. in Textile engineering from North Carolina State University

3. Jari Oinas; Oinas\_Jari\_CCL

* Fuel and Performance Operations Director at Carnival Cruise Lines. M.Sc. in Mechanical Engineering from Aalto University. Past analytics experience with energy efficiency analytics and modeling

4. Anuj Shelat; anujshelat

* Data Analyst at Panasonic, Bachelor’s in Chemical Engineering from Penn State University

5. David Chang; persiane

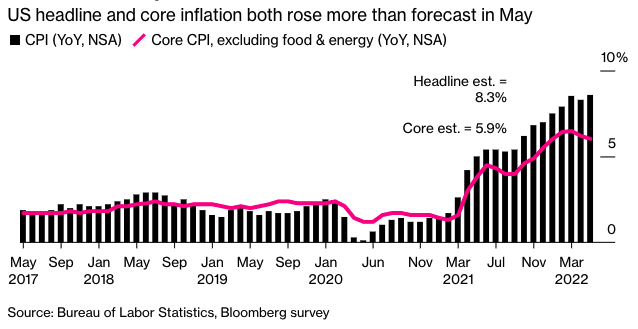
* Financial Analyst at National Academy of Medicine, B.A. in Theatre and Public Health from Hampshire College.

**OBJECTIVE/PROBLEM (5 points)**

**Project Title:** The Effect of Macroeconomic Indicators on Stock Market Performance

**Background Information on chosen project topic:**

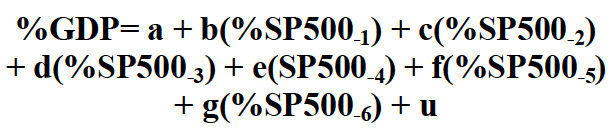
There is a common belief that the stock market reacts sensitively to economic events as investors are inclined to follow economic data, released by the government and monetary policy. On June 10th, 2022, year-over-year inflation data for the month of May 2022 was released, with a scorching 8.6% pace, the highest in the last 40 years. The S&P 500 plummeted 2.9% and NASDAQ dropped 3.53%. 3 days later, S&P 500 officially entered a bear market with investors' fears over tightening monetary policies and recession. On June 13, 2022, the S&P 500 stock market index officially entered into a bear market, which is described as when the equity index has experienced a 20% decline or more over a sustained period of time.



A relevant study by the International Monetary Fund in 1998 examined stock market responses to different macroeconomic announcements across different states of the economy and for example, they found strong evidence of significance for reactions of stock prices on M-1, inflation rate announcements and discount rate in all states of economy for different market cap sizes. Thus, some of the macroeconomic indicators can be used to predict the trends of the stock market.

It is apparent that there is a relationship between stock market performance and macroeconomic performance. But the relationship is not always clear. A bear market is often (but not always) a signal that preludes an economic recession. There have been 26 bear markets since 1929, but only 15 economic recessions during that time.

On the other hand, however, investors often priced in stocks or mutual funds in the market, suggested by the traditional equity valuation model like Discount Cash Flow. For example, if investors anticipate a recession is coming, then they will expect diminishing earnings and the value of stocks will decrease. A study by Brad Comincioli suggests a “casual” relationship between the stock market and GDP data. And the stock market, as a leading index, can predict the change of GDP up to three quarters.



Linear regression model with % change of GDP on past quarter % change in S&P 500

| Variable | Estimated | Coefficient | T-Statistic |
| --- | --- | --- | --- |
| Last 1 quarter | %SP500-1 | 0.0359 | 3.0233\*\*\* |
| Last 2 quarter | %SP500-2 | 0.0167 | 1.4076 |
| Last 3 quarter | %SP500-3 | 0.0158 | 1.3123 |
| Last 4 quarter | %SP500-4 | -0.0004 | 0.0338 |
| Last 5 quarter | %SP500-5 | 0.0009 | 0.0794 |
| Last 6 quarter | %SP500-6 | -0.0076 | 0.6757 |
|  |  |  |  |
| Adjusted | R2 | 0.779 |  |
| \* Significant at 0.1 level | |  |  |
| \*\* Significant at 0.05 level | |  |  |
| \*\*\* Significant at 0.01 level | |  |  |
|  |  |  |  |
|  | | |  |

**Problem Statement (clear and concise statement explaining purpose of your analysis and investigation):**

The purpose of this analysis is to determine the relationship between specific economic indicators and overall market performance, based on three major U.S. stock market indices. This will be done using a linear regression model, allowing us to determine how much of an effect each predictor has on market performance.

The casual relationship between macroeconomic and the stock market is controversial and complex. Does the economy drive the stock market? Or do poor returns in the market reduce economic performance? It may be due to reflexivity, in which positive or negative feedback loops between expectation and economic fundamentals can cause stock prices to substantially deviate from equilibrium prices. So it can be difficult to find casual relationships in the market due to the interaction between expectation and economic fundamentals and the emotional part of investors.

However, correlation between macroeconomics and the stock market is a valuable topic to research and it is also instructive to examine the change of the weighted relationship between particular economic indicators and the stock market in different periods, as a reflection of reflexivity

**State your Primary Research Question (RQ):**

What is the relationship between the U.S. stock market and macroeconomic indicators for the United States?

**Add some possible Supporting Research Questions (2-4 RQs that support problem statement):**

What predictors are most influential? Least influential? What economic indicators are most important in affecting stock market performance? Do the effects of predictors change over time?

Are there certain conclusions we can make by studying particular periods of market performance? (Dot com bubble, 2008 financial crisis, 1970’s inflationary decade, 2009-2019 bull market, 1982-1999 bull market). Are there certain economic risk indicators that signal a bear market? Are there economic indicators that signal a bull market?

**Business Justification:** **(Why is this problem interesting to solve from a business viewpoint? Try to quantify the financial, marketing or operational aspects and implications of this problem, as if you were running a company, non-profit organization, city or government that is encountering this problem.)**

We are interested in exploring the relationship between market performance and major economic indicators such as consumer sentiment, inflation, equity valuation, US Federal Reserve interest rates, the cost of oil, and more. Are there economic factors that improve stock market performance?

Many business firms may shift their balance sheet’s asset allocation strategies during periods of high or low performance. Nonprofit organizations with endowments may increase or decrease their annual draw down of endowed funds depending on a rolling average of market performance. Market performance is a driver of when companies choose to complete stock buybacks or make an initial public offering.

**DATASET/PLAN FOR DATA (4 points)**

**Data Sources (links, attachments, etc.):**

We will use the above Financial APIs.

Yfinance API:[**https://pypi.org/project/yfinance/**](https://pypi.org/project/yfinance/)

Nasdaq data link:[**https://docs.data.nasdaq.com/**](https://docs.data.nasdaq.com/)

Alphavantage:[**https://www.alphavantage.co/documentation/**](https://www.alphavantage.co/documentation/)

**Data Description (describe each of your data sources, include screenshots of a few rows of data):**

1. Yfinance API: stock and etf price information, public companies’ fundamentals

2. Nasdaq data link,API : FRED data, US treasury, Consumer sentiment index data, commodity price data

3. Alphavantage API: currency exchange rate, crytos price data, economic index data

**Key Variables: (which ones will be considered independent and dependent? Are you going to create new variables?** **What variables do you hypothesize beforehand to be most important?)**

Dependent Variables:

Stock Market Performance Data:

· Quarterly market returns data, transformed into percentage gain or loss since the previous quarter.

· We plan to use major stock market indices to measure impact on market performance.

* Russell 2000 (small cap market index)
* S&P 500 (large cap market index)
* NASDAQ (large cap market index, weighted towards technology stocks)

Independent Variables:

· Macroeconomic data (Predictors/Factors for market conditions)

* Consumer Sentiment (Index)
* GDP
* Unemployment rate
* Average weekly initial claims for unemployment insurance
* Retail sales
* Industrial output
* CPI or PCE (inflation)
* PPI
* Shiller CAPE PE/10
* Federal Reserve Interest Rate
* LIBOR
* DXY
* Oil Prices ($/barrel crude oil)
* Housing Data (building new homes)/Housing Starts
* Housing permits for new private housing starts
* Capital Expenditure
* Export and Import
* Government Spending
* Average hours employed people spent working on days worked by day of week
* Total Business Inventories
* M1
* Nonfarm payrolls
* Trade Balance
* New orders for consumer goods and materials

**APPROACH/METHODOLOGY (8 points)**

**Planned Approach (In paragraph(s), describe the approach you will take and what are the models you will try to use? Mention any data transformations that would need to happen. How do you plan to compare your models? How do you plan to train and optimize your model hyper-parameters?))**

We plan to build a Linear Regression model using least squares estimation. The model will take the following form: lm(% increase in Quarterly Market Performance ~ Macroeconomic Data Indicators). If time permits, we will explore other models such as K Nearest Neighbor Regression.

Variables: For market performance variables, we plan to transform the returns into percentage change over the previous quarter. Due to the large number of independent variables that we propose to work with, we will use variable selection to reduce the number of variables selected by the model. We plan to use modern regularization methods such as LASSO or Elastic Net. Other pre-processing may include data scaling and/or Principle Component Analysis.

We will check the model’s adherence to the assumptions of linear regression:

* Linear relationship between independent variables and dependent variable.
* Multivariate normality
* No or little multicollinearity
* No auto-correlation
* Homoscedasticity

Given that most of the indicators are macroeconomic, one issue that may arise may be that all of the indicators could be correlated with one another. Are there certain combinations of predictors that are predictive? We will need to check for multicollinearity using a correlation plot. Based on model performance, we may use Principal Component Analysis to improve model fit. If there is not a linear relationship between market performance and macroeconomic data indicators, we may experiment with data transformation and/or non-linear data models such as regression splines.

**Anticipated Conclusions/Hypothesis (what results do you expect, how will you approach lead you to determining the final conclusion of your analysis) Note: At the end of the project, you do not have to be correct or have acceptable accuracy, the purpose is to walk us through an analysis that gives the reader insight into the conclusion regarding your objective/problem statement**

Our hypothesis is that a strong economy (as indicated by strong or healthy macroeconomic indicators) causes strong market performance. The underlying assumptions behind our hypothesis are the mainstream economic theories of price equilibrium, rational expectations, and the efficient market hypothesis. Given that the analysis will be done with data over a long period of time based on quarterly returns of major equity indices, the research group assumes that individual stocks will not have an effect and the market will be efficient. We assume that investors are rational and make rational investment decisions, and that stock market prices will move towards a price equilibrium that is defined by economic fundamentals such as supply and demand. In efficient markets, macroeconomic factors should be the only predictors of the value of market indices. Therefore, the regression analysis done by the team should result in a strong correlation and that we will be able to reject the null hypothesis.

If our regression analysis does not result in a strong correlation as expected, one explanation (as popularized by behavioral economists and investors such as George Soros) may be that markets are characterized by reflexivity. In other words, investors do not make their decisions based on reality (such as macroeconomic economic indicators) but rather based on their perception of reality (what they think is happening in the economy). Were this the case, we may expect to see high heteroscedasticity in our regression model’s fit.

As discussed previously, the team will assess the value of each of the predictors. Predicting the change in major macroeconomic factors and utilizing the team’s assessment should provide ample analysis to properly time the market. Lastly, by studying specific periods of both strong and weak market performance, the team will finalize the conclusions about the studied predictors.

**What business decisions will be impacted by the results of your analysis? What could be some benefits?**

The outcome of this analysis will allow investors to better understand the relationship between certain variables and market conditions. Having a better understanding of this relationship could allow investors to minimize risk when buying and selling stocks. The main benefit of this analysis is the potential to predict performance in the market based on specific economic indicators, and being able to improve overall investment strategy. Firms expecting weaker market performance may choose to make more conservative investment decisions, reduce risk exposure in their balance sheet, and take steps to reduce expenditures (such as freeze hiring or layoffs). Other benefits include being able to determine the impact of each economic indicator and also potentially predicting major stock market events such as large crashes.

**PROJECT TIMELINE/PLANNING (2 points)**

**Project Timeline/Mention key dates you hope to achieve certain milestones by:**

June 22, 2022: Group Submission of Project Proposal

June 29, 2022: Compile Data sets, data transformations, and complete initial exploratory data analysis. Build and train the first model on the S&P 500 index. Discuss any initial findings and analysis.

July 6, 2022: Group Submission of Progress Report Report and recorded Progress Report presentation.

July 13, 2022: Team completes training and fit of any additional models. Draft Jupyter Notebook Report. Outline of Video Presentation.

July 16/17, 2022: Record Video Presentation via Microsoft Teams/Zoom/Google Meet

July 20, 2022: Group Submission of Final Video Presentation

July 24, 2022: Group Submission Jupyter Notebook Report, Final Video Presentation slides, code, etc.