MGT 6203 Group Project Final Presentation

Team #42

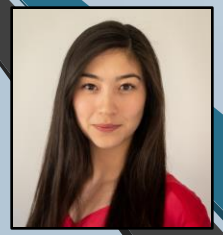
Team Members

- Xi Lu (xlu355): This is my 5th course in the program, and recently I have worked on a project predicting wildfire spread using SMOTE and XGBoost models for CSE 6242. My undergrad degree is in Public Planning.

- Ligeng Peng (lpeng61): I have a bachelor's degree in engineering from the University of Calgary. I am a Project Manager in BI and Data Service, and my current working project is Vision AI to detect movement from Crane in construction site.

- Daniel Tong (dtong31): I am an aspiring data analyst, recently graduating from UCSD with a Bachelor's in Data Science. This will be my 3rd course of the program.

- Guchuan Gao (ggao43): I am a data scientist/mechanical engineer working in Canadian oil sands, with a primary focus on developing autonomous haulage technology in the mining industry. I am passionate about exploring AI applications in image recognition and natural language processing.



- Isabelle Victoria Zelazny (izelazny3):I am a geologist working in the Canadian oil and gas industry with a specialty in unconventional geochemistry. My goal is to develop analytical skills so I can improve how exploration and development is done in the industry.

Understanding the Effects of Financial Ratios on Stock Performance

- **Background:** Financial ratios provide investors with opportunities to evaluate a company's true performance and are often crucial fundamentals used in stock analysis.
- **Business Justification:** Effective allocation of capital investment can be improved by understanding which financial ratios best predict the returns of a stock
- **Impact of Analysis:** Businesses seeking investors tailor company financial ratios to align with ones that predict better performance [1], while also helping both companies and individuals with their own investment decisions.

Expected Outcomes

- Better understanding of the relationship between financial ratios and stock prices
- Identification of key factors that drive stock performance provide information to predict how stocks might perform in the future and to make better investment decisions
- Make more informed investment decisions and potentially generate higher returns on investments

- **Anticipated Conclusions/Hypothesis:** The following 6 financial ratios are typically expected to influence stock prices: working capital ratio, the quick ratio, earnings per share (EPS), price-earnings (P/E), debt-to-equity, and return on equity (ROE) [2]

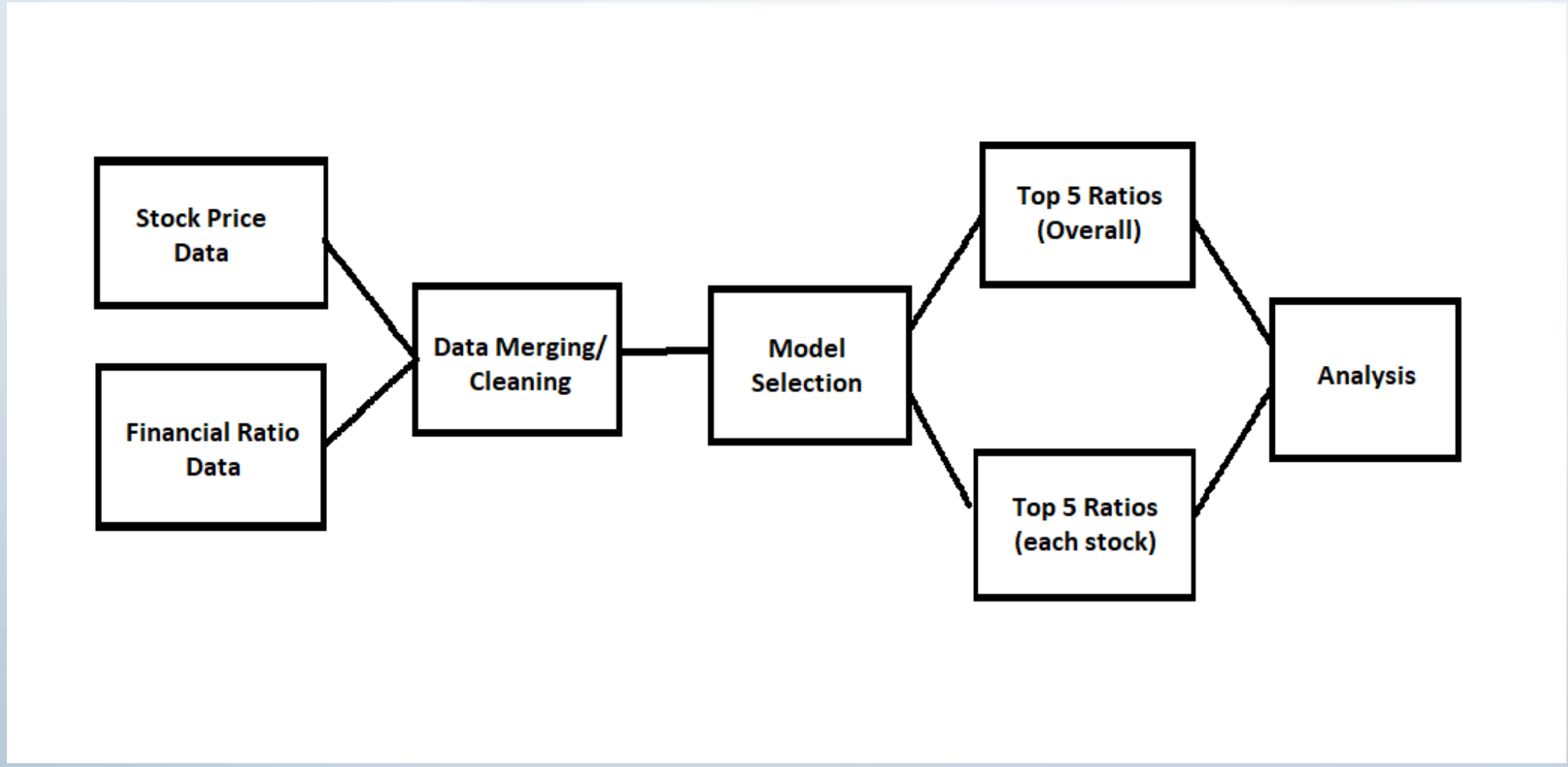
Approach

- **Problem Statement:** The key objective of this project is to analyze financial ratios' correlations with stock prices among Dow 30 stocks and use factor driven analysis to understand how financial ratios drive stock performance
- Which financial ratios best predict the returns of the Dow 30 stocks?
- How do general market predictors compare to predictors for individual stocks? Do different industries have different financial ratios as their predictors?

Methodology

- Use R for all data processing, modeling, and analysis
- Explore PCA, Lasso Regression, and Random Forest to determine the best technique for feature importance
- Compare selected model with existing linear regression/support vector machine stock prediction techniques [3]
- Using selected model, find the top 5 most important financial ratios for both the general market and for individual stocks, compare and analyze results

Workflow


Stock Price Data
Financial Ratio Data
Data Merging/ Cleaning
Model Selection
Top 5 Ratios (Overall)
Top 5 Ratios (each stock)
Analysis

Datasets

- Wharton Research Data Services: https://wrds-www.wharton.upenn.edu/
  - Dow 30 stocks' 75 Financial ratios by month from Jan 2010 to Dec 2022
- Yahoo Finance via R tidyquant
  - Dow 30 stock prices by month from Jan 2010 to Dec 2022

- Dependent variable: Stock Price
- Independent variables: 75 different Financial Ratios

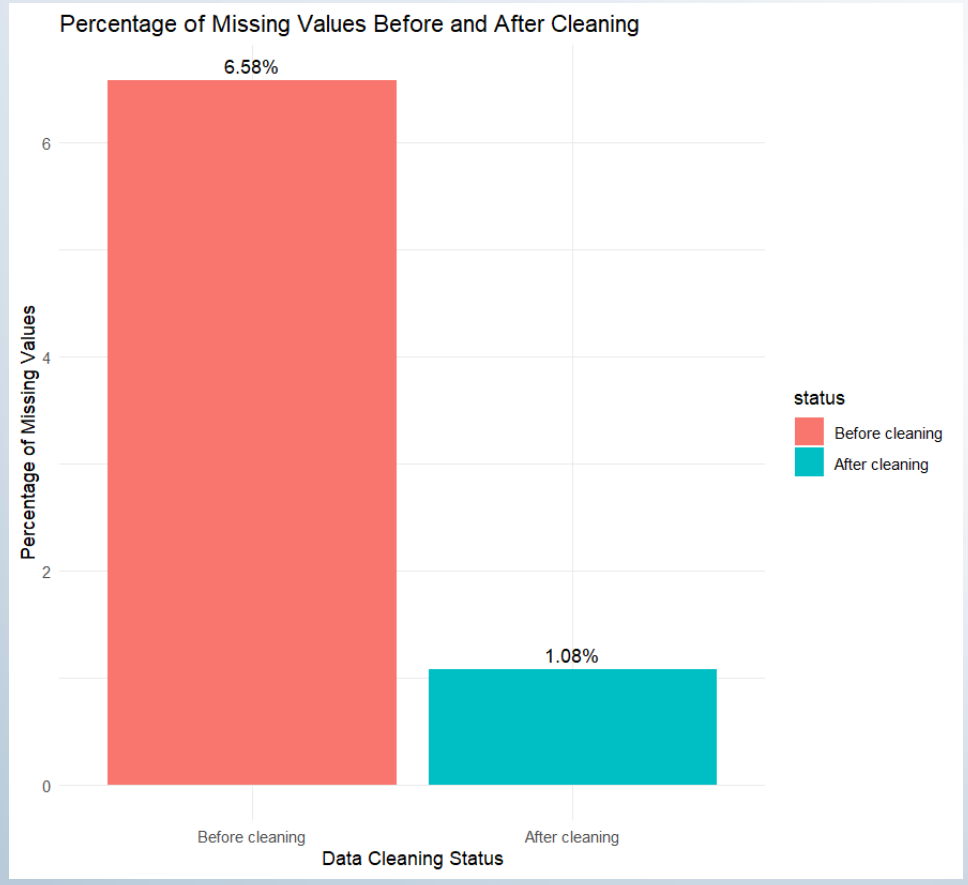
Sample Data from Wharton Research Data Service

public_date	TICKER	CAPEI	bm	evm	pe_op_	pe_op_	pe_exi	pe_inc
20100131	MSFT	17.445	0.181	9.091	17.835	17.949	18.299	18.299
20100228	MSFT	17.365	0.166	9.138	15.332	15.582	15.84	15.84
20100331	MSFT	17.722	0.166	9.138	15.662	15.917	16.181	16.181
20100430	MSFT	18.48	0.166	9.138	16.329	16.595	16.87	16.87
20100531	MSFT	15.296	0.181	9.939	13.163	13.368	13.368	13.368

Data Cleaning

- Step 1: remove rows with N/A close prices
- Step 2: remove Financial ratios with >500 NAs
- Step 3: impute remaining missing financial ratios with each stock's closest adjacent financial ratio
- Step 4: remove 4 financial ratios that are missing for the entire duration for JPM and TRV

Data Cleaning



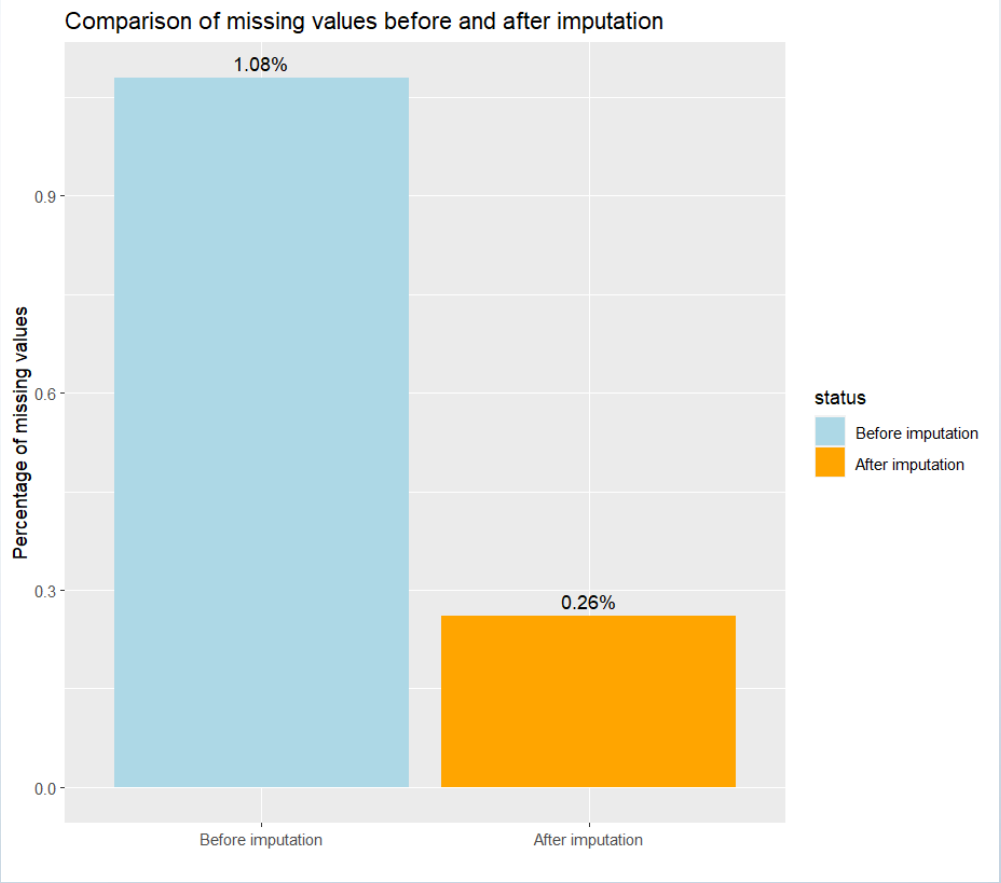
Example: Removing financial ratios with >500 NAs in Step 2

- Before: **6.58%**
- After: **1.08%**

Data Cleaning

Example: Impute missing financial ratios with closet adjacent financial ratios in Step 3

- Before: **1.08%**
- After: **0.26%**

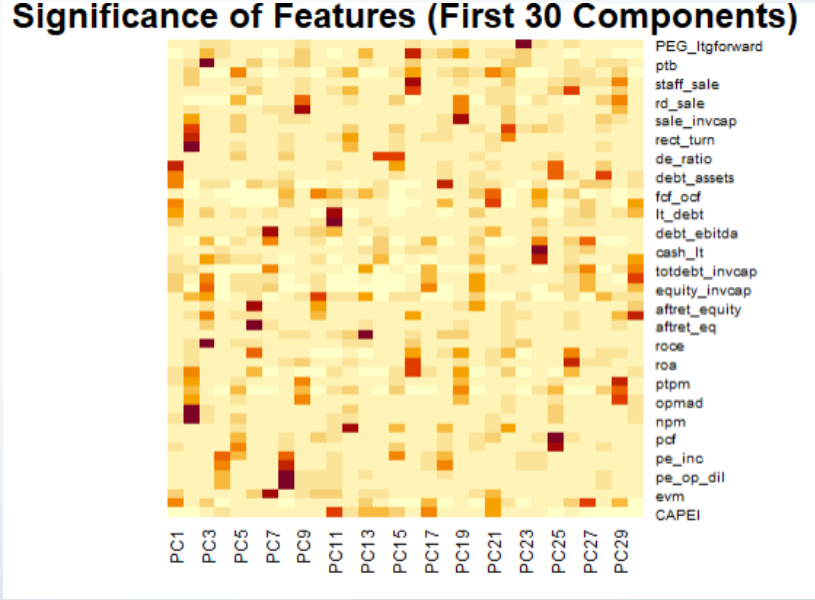


Model Selection

A Comparison of PCA, Lasso Regression, and Random Forest

PCA

- Why use PCA?
- Poor for identifying feature importance, results were too uncertain to rely upon
- Deemed it better to try other approaches instead

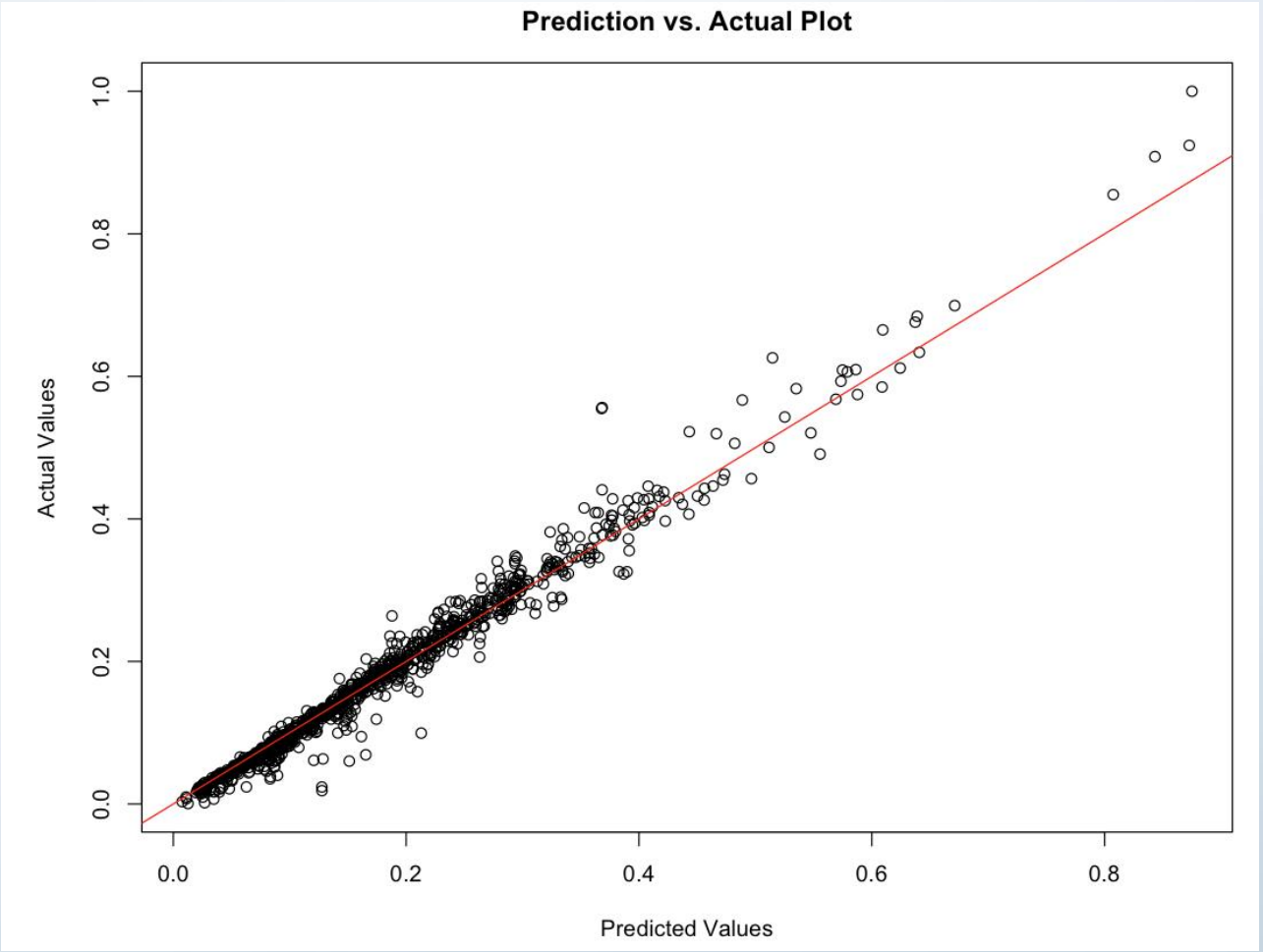


Lasso Regression

- Why use Lasso Regression?
  - Cross validation was used to choose optimal lambda (maybe include actual lambda value here)
- R-squared value of 53.4%

Random Forest

- Why use Random Forest?
- R-squared value of 97.5%

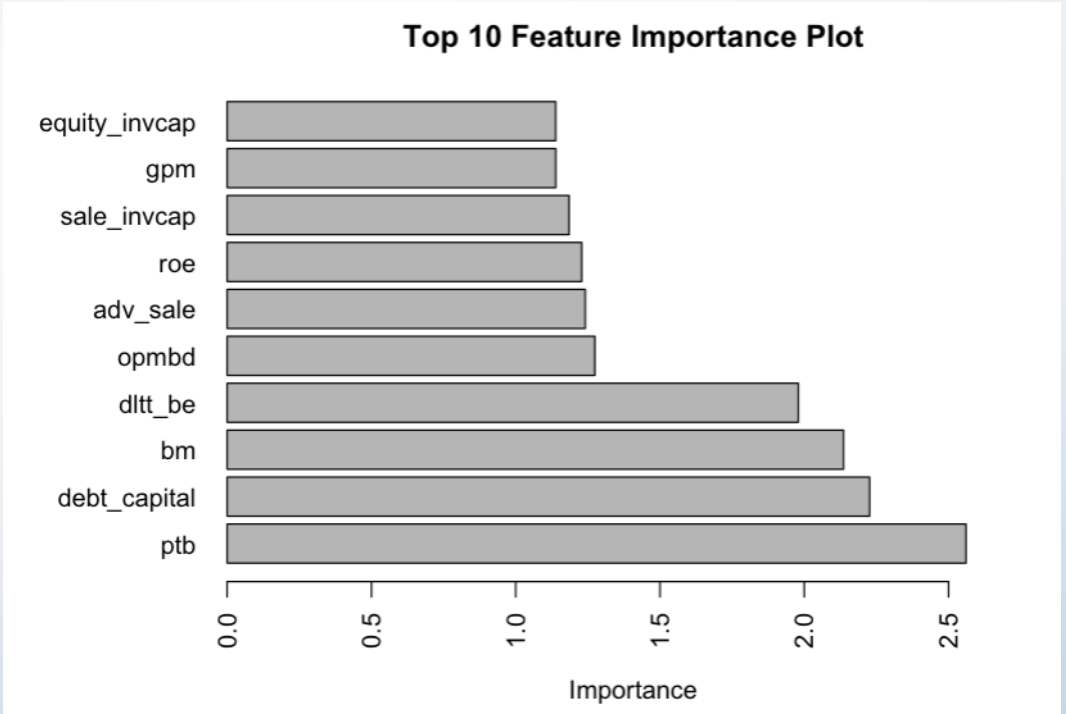


Compare with the existing models [4]

Model Name	R-Squared
Linear Regression	0.73
Support Vector Regression	0.93
Radom Forest Model	0.975

Random Forest

- 10 most important financial ratios in determining price, as identified by the random forest model



Findings

- 10 companies' stock prices are heavily influenced by P/E ratio
- 3 companies' stock prices are heavily influenced by cash balance/ total liability ratio
- Technology sector stocks are strongly connected with price/book ratio
- Financial services stocks are strongly connected with debt/asset ratio
- Some companies have unique financial ratios closely tied to their stock prices

Conclusion

- Our model output based on the Dow 30 stocks in the past 20 years indicates a variety of financial ratios that have impacted these stocks' prices.
- Different companies have different financial ratios that tend to be more closely correlated to their stock prices.
- Our tool serves as a guide to help investors evaluate stock performance utilizing financial ratios.

References

- [1] B Korcan Ak, Patricia M Dechow, Yuan Sun, and Annika Yu Wang. (2013) The use of financial ratio models to help investors predict and interpret significant corporate events. Sage Journals. Vol 38. Issue 3
- [2] Glenn Wilkins. 6 Basic Financial Ratios and What They Reveal. Investopedia. 2022. https://www.investopedia.com/financial-edge/0910/6-basic-financial-ratios-and-what-they-tell-you.aspx#:~:text=There%20are%20six%20basic%20ratios,return%20on%20equity%20(ROE).
- [3] Subramanian, K. & Prabhu, M. K. (2014). Predicting Stock Prices Using Financial Ratios: A Multiple Linear Regression Analysis. Journal of Finance and Accounting, 2(7), 383-387.
- [4] Gururaj, V., Shriya, V. R., & Ashwini, K. (2019). Stock Market Prediction using Linear Regression and Support Vector Machines. Int J Appl Eng Res, 14(8), 1931-1934.