How reliable is stock price prediction using macroeconomic drivers?

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Dataset Overview

- Range: 2013 – 2023
- Adjusted size: 2536 instances, 6 features
- From U.S. Bureau Of Labor Statistics:
  - Inflation Rate (monthly)
    - CPI for All Urban Consumers
    - All items less food and energy in U.S. city average, all urban consumers, not seasonally adjusted
- From Yahoo Finance:
  - Progress Software Company (PRGS) historical daily stock prices
  - Oracle Corporation (ORCL) historical stock daily prices
  - Market Index (^SPY) (daily)
  - Interest Rate (^TNX): daily 10-year Treasury Yield

Research Questions

1. What is the key macroeconomic factor that drives PRGS stock price?

2. How reliable is stock price prediction using macroeconomic drivers?

Company Overview

Progress Software Company (PRGS)

- Software publishing company that provides application development and deployment technologies

- Known for OpenEdge software – platform for business application development and deployment

- Dependent variable

Oracle Corporation (ORCL)

- Global technology company that offers a range of cloud-based software applications and industry solutions, as well as infrastructure technologies, hardware products

- One of the independent variables

Algorithm

Data Cleaning

- 5 original datasets: PRGS, ORCL, Market Index, Interest Rates, Inflation Rates
- Converted monthly inflation rates to daily
- Dropped rows with missing values in Interest Rates dataset
- Merged the datasets into one dataset

Algorithm

- Multiple Linear Regression

	Date	PRGS	ORCL	Market_Index	InflationR	InterestR
0	2013-01-02	21.540001	34.689999	146.059998	0.3	1.839
1	2013-01-03	20.889999	34.310001	145.729996	0.3	1.899
2	2013-01-04	22.020000	34.610001	146.369995	0.3	1.915
3	2013-01-07	22.400000	34.430000	145.970001	0.3	1.903
4	2013-01-08	22.490000	34.439999	145.550003	0.3	1.871
5	2013-01-09	22.730000	34.459999	145.919998	0.3	1.852
6	2013-01-10	23.010000	34.910000	147.080002	0.3	1.894
7	2013-01-11	23.080000	34.860001	147.070007	0.3	1.875
8	2013-01-14	23.230000	34.959999	146.970001	0.3	1.857
9	2013-01-15	23.320000	34.700001	147.070007	0.3	1.831

	PRGS	ORCL	Market_Index	InflationR	InterestR
count	2536.000000	2536.000000	2536.000000	2536.000000	2536.000000
mean	34.773734	51.776861	274.952677	0.219361	2.159226
std	9.156709	16.027252	87.228861	0.211857	0.704074
min	20.660000	29.959999	145.550003	-0.500000	0.499000
25%	25.945001	39.977500	205.267502	0.100000	1.720000
50%	34.970000	47.924999	259.794999	0.200000	2.220000
75%	42.650002	56.602499	330.717499	0.300000	2.643500
max	54.009998	103.650002	477.709991	0.800000	4.234000

Results & Analysis – Regression Summary

```
                    OLS Regression Results
================================================================
Dep. Variable:              PRGS   R-squared:               0.848
Model:                       OLS   Adj. R-squared:          0.847
Method:            Least Squares   F-statistic:             3520.
Date:           Thu, 13 Apr 2023   Prob (F-statistic):       0.00
Time:                   16:25:02   Log-Likelihood:        -6828.0
No. Observations:           2536   AIC:                   1.367e+04
Df Residuals:               2531   BIC:                   1.370e+04
Df Model:                      4
Covariance Type:        nonrobust
================================================================
                 coef    std err       t     P>|t|    [0.025    0.975]
----------------------------------------------------------------
const          3.4879      0.354     9.855    0.000    2.794     4.182
ORCL          -0.1532      0.017    -8.792    0.000   -0.187    -0.119
Market_Index   0.1279      0.003    39.795    0.000    0.122     0.134
InflationR    -2.8613      0.378    -7.562    0.000   -3.603    -2.119
InterestR      2.1669      0.104    20.745    0.000    1.962     2.372
================================================================
Omnibus:                 402.028   Durbin-Watson:            0.030
Prob(Omnibus):             0.000   Jarque-Bera (JB):       747.391
Skew:                      0.986   Prob(JB):             5.08e-163
Kurtosis:                  4.784   Cond. No.             1.67e+03
================================================================
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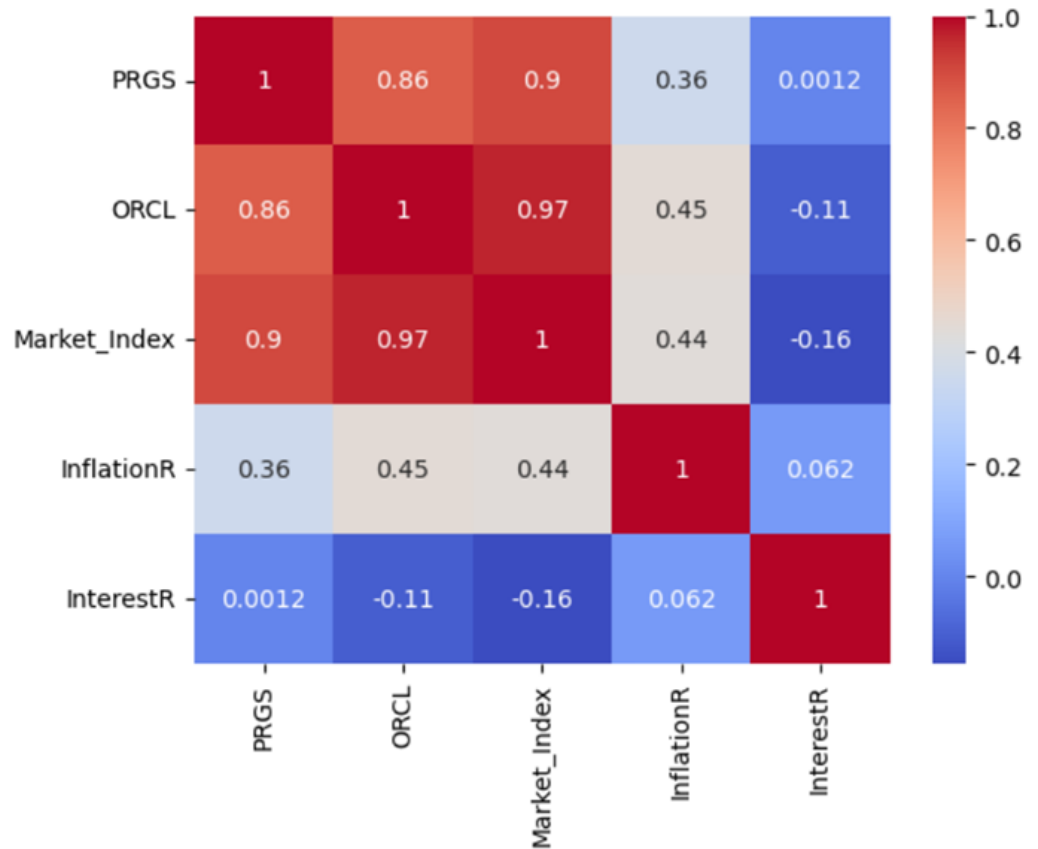
- R-squared: 0.848
- Coefficients:
  - ORCL: -0.1532
  - Market Index: 0.1279
  - Inflation Rate: -2.8613*
  - Interest Rate: 2.1669*

*For every 1% increase in inflation rates, PRGS price will decrease by -$0.0286.

*For every 1% increase in interest rates, PRGS price will increase by $0.0217.
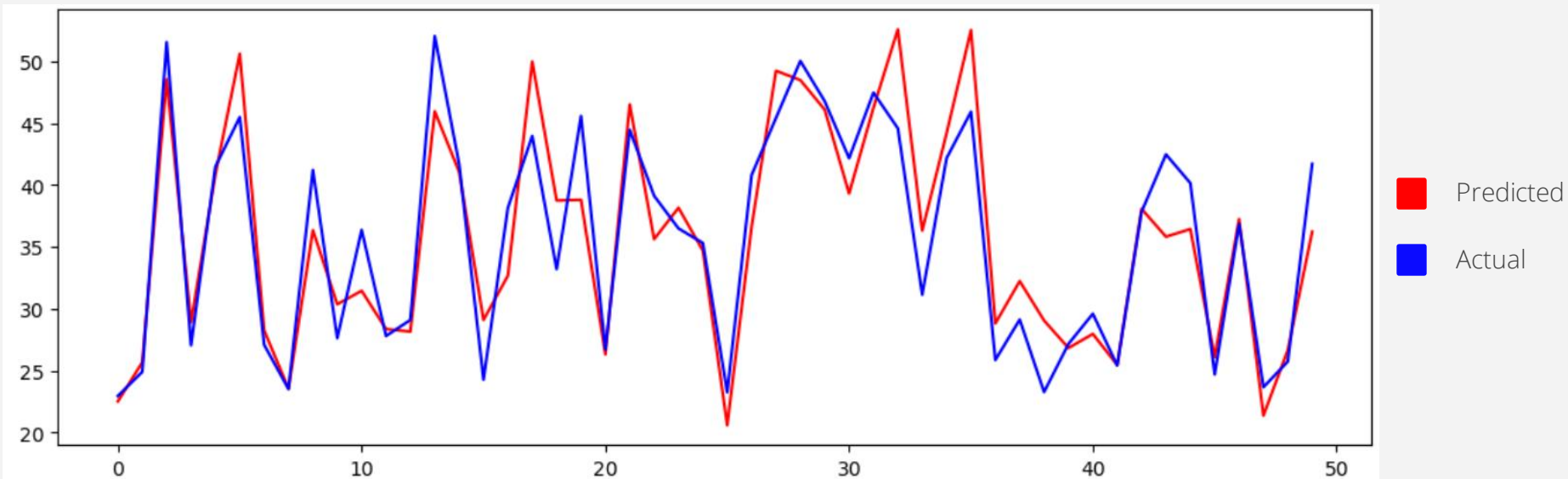
Results & Analysis – Correlation Map

- Highest correlation: Market Index, ORCL

- Lowest correlation: Interest Rate

Results & Analysis – Multiple Linear Regression
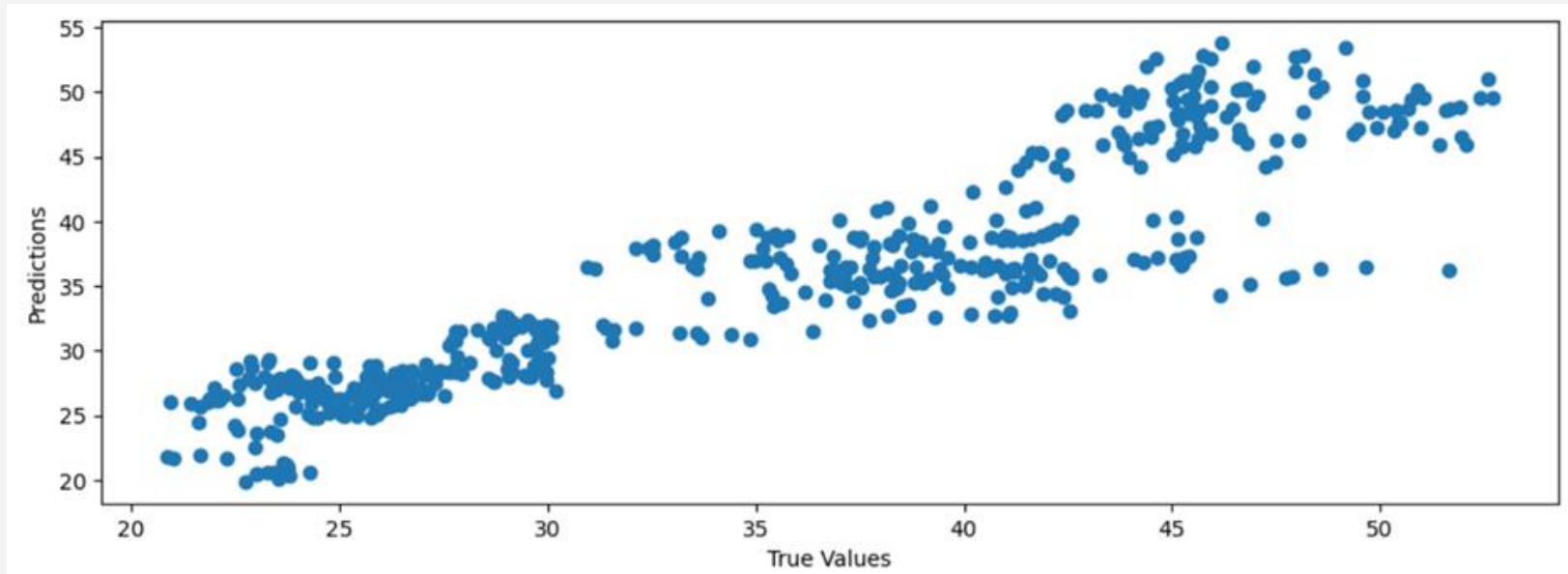
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(of training set)

Coefficient: [[-0.16511697 0.1308061 -2.87384632 2.17374318]]
Intercept: [3.31958832]
```

Results & Analysis – Multiple Linear Regression

- RSME: 3.71749
- R square (actual prices, predicted prices): 0.828295

Results & Analysis – Multiple Linear Regression

Earliest dates

	Date	y_test	y_pred	diff
498	2013-01-09	22.730000	19.880502	2.849498
253	2013-01-18	23.540001	20.068856	3.471145
313	2013-01-29	24.299999	20.578199	3.721800
194	2013-02-01	23.799999	20.343504	3.456495
438	2013-02-06	23.010000	20.425022	2.584978
59	2013-02-07	23.010000	20.451070	2.558930
423	2013-02-12	23.400000	20.566296	2.833704
499	2013-02-14	23.600000	20.675414	2.924586
25	2013-02-20	23.250000	20.578635	2.671365
77	2013-03-06	23.750000	20.958597	2.791403

Most recent dates

	Date	y_test	y_pred	diff
2	2022-12-07	51.570000	48.572749	2.997251
391	2022-12-09	51.700001	48.755744	2.944257
162	2022-12-16	50.970001	47.307838	3.662163
326	2022-12-23	50.459999	47.635788	2.824211
104	2022-12-27	50.480000	47.653742	2.826258
321	2022-12-28	49.900002	47.199739	2.700263
308	2022-12-30	50.450001	47.704285	2.745716
290	2023-01-04	51.410000	45.906763	5.503237
13	2023-01-06	52.060001	45.972680	6.087321
273	2023-01-20	51.950001	46.545667	5.404334

Evaluation & Takeaways

Conclusion

- Market index has the highest correlation to PRGS stock price.

- ORCL stock price has the highest impact per unit change.

- R squared indicates good fit of the model to the data, but RMSE implies results are not very accurate.

1. **What is the key macroeconomic factor that drives PRGS stock price?**
   According to the model, ORCL.

2. **How reliable is stock price prediction using macroeconomic drivers?**
   According to the model, it is not entirely reliable.

Takeaways

➢ Realistically, should not rely on only macro factors to predict stock prices.

Q & A

Thank You