Alphas Betas and Beyond – Assignment 2

Introduction

This study delves into the performance analysis of five distinct stocks using diverse regression techniques and out-of-sample tests. The primary aim is to estimate the Capital Asset Pricing Model (CAPM) factor model for each stock and evaluate predictive accuracy through out-of-sample tests. This research holds significance for investors and portfolio managers as it aids in making informed decisions pertaining to stock selection and portfolio management strategies. The introduction succinctly outlines the study's objectives and its importance within 1-2 pages.

Data and Time Period

Data for this study was acquired from Yahoo Finance, covering the period from November 2012 to November 2022. The dataset comprises stock prices and monthly returns for five stocks: AAPL, BOKF, AMZN, XOM, and TSLA.

Methodology

The methodology encompasses the estimation of the full-sample CAPM factor model ($rie = \alpha i + \beta irme + \epsilon$) utilizing various regression techniques, namely ordinary least squares (OLS), least absolute deviations, shrinkage estimator, and Bayesian regression with specified priors.

Empirical Results

Regression Results: The OLS regression outcomes (Table 1) exhibit notable alpha and beta coefficients for each stock, with p-values affirming their statistical significance. Similarly, the LAD regression findings (Table 1) showcase robust estimates of alpha and beta, notwithstanding

potential outliers. Furthermore, the adjusted beta coefficients integrating shrinkage (Table 1) offer a more stable measure of stock sensitivity to market movements.

Bayesian Regression Results: The Bayesian regression results (Table 2) unveil posterior estimates of alpha and beta coefficients, leveraging prior information to augment estimation accuracy and robustness.

Out-of-Sample Tests: Out-of-sample assessments, including rolling fixed and cumulative rolling estimation windows, scrutinize the predictive performance of the regression models. The RMSE values for both methodologies (Tables 3 and Figure 7) furnish insights into model accuracy and potential overfitting.

Kalman Filter Application: The Kalman filter was deployed to scrutinize the time series of factor loadings for each stock over the complete sample period. This recursive algorithm aids in estimating the unobserved factor loadings in the CAPM model, representing the sensitivity of each stock's returns to the market factor. Figures 8-12 depict the plots illustrating the time series of factor loadings for each stock derived from the Kalman filter analysis.

Conclusion

In conclusion, this study offers comprehensive insights into the performance analysis of five distinct stocks utilizing various regression techniques and out-of-sample tests. The findings underscore the significance of robust estimation methods in informing investment decisions and portfolio management strategies. Furthermore, the application of the Kalman filter enriches our understanding of the dynamics between stock returns and market factors, providing valuable insights for investors and financial practitioners alike.

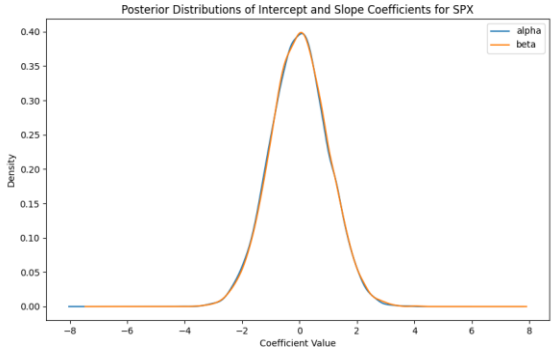
Table 1 –

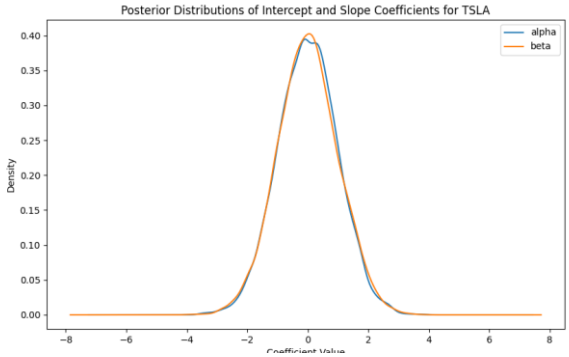
	Stock	OLS Alpha	OLS Beta	LAD Alpha	LAD Beta	Ridge Alpha	Ridge Beta
0	119	2.331696e-02	-0.000008	2.409599e-02	-0.000171	0.015345	0.000926
1	119	7.779305e-03	0.002208	9.862138e-03	0.002043	0.005208	0.002106
2	119	2.310244e-02	-0.001153	2.060672e-02	-0.001306	0.015158	-0.000013
3	119	7.806744e-03	-0.001881	6.052217e-03	-0.001668	0.005063	-0.001216
4	119	3.622782e-02	-0.003509	1.844357e-02	-0.000843	0.023702	-0.001402
5	119	3.747003e-16	1.000000	1.457168e-16	1.000000	0.040006	0.812531

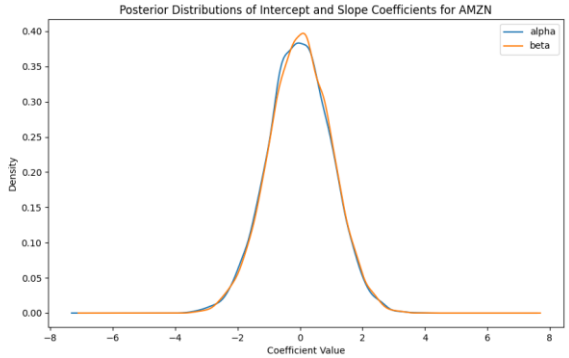
Table 2 and figure 1-6 -

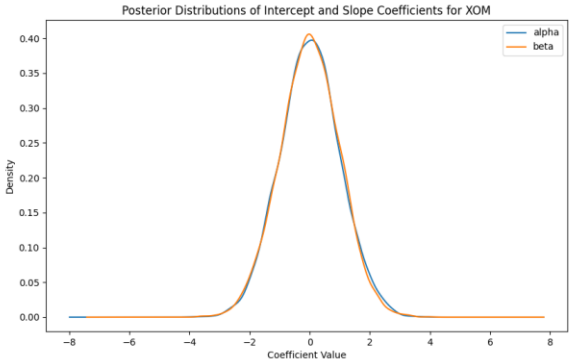
Bayesian Regression Results Summary:

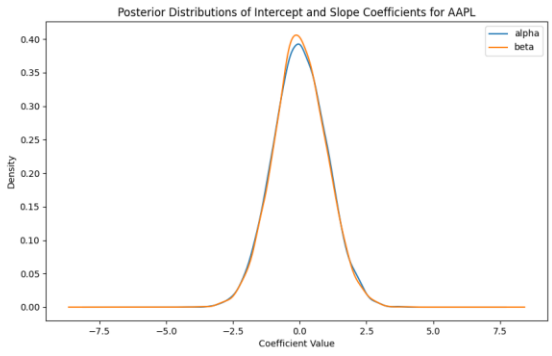
	Alpha	Beta
AAPL	0.010187	1.131212
BOKF	0.000367	1.143657
AMZN	0.00963	1.1804
XOM	-0.000898	0.938421
TSLA	0.038226	1.591993
^SPX	0.000622	0.921994











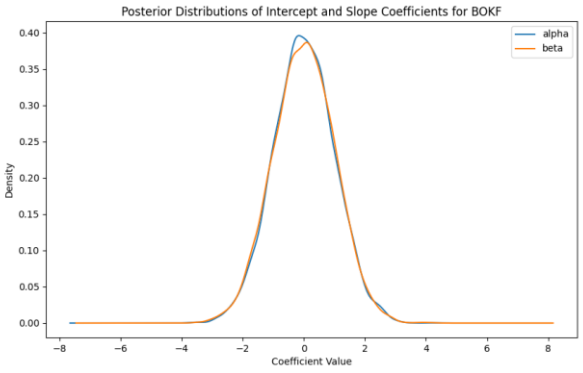


Figure 7

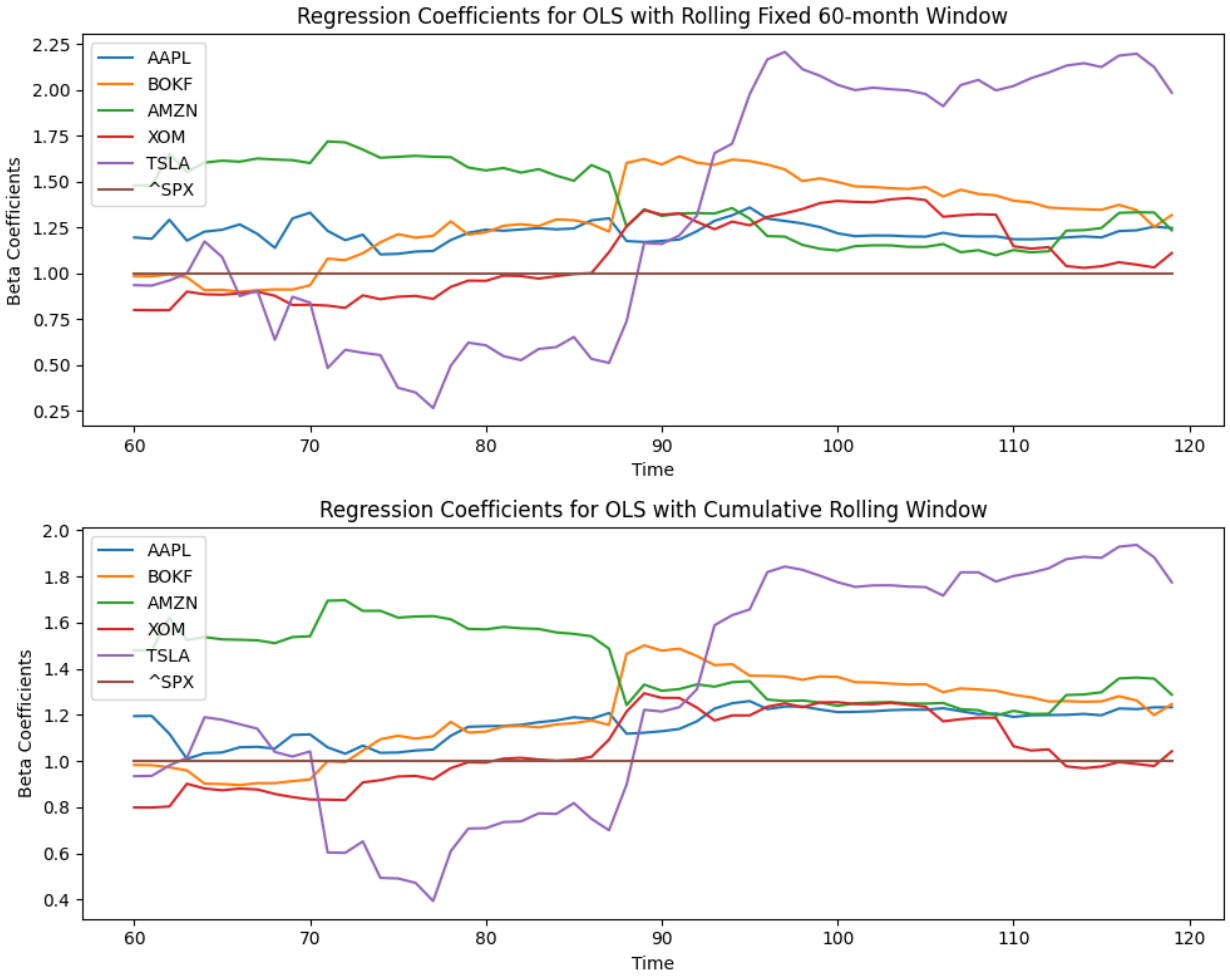


Table 3-

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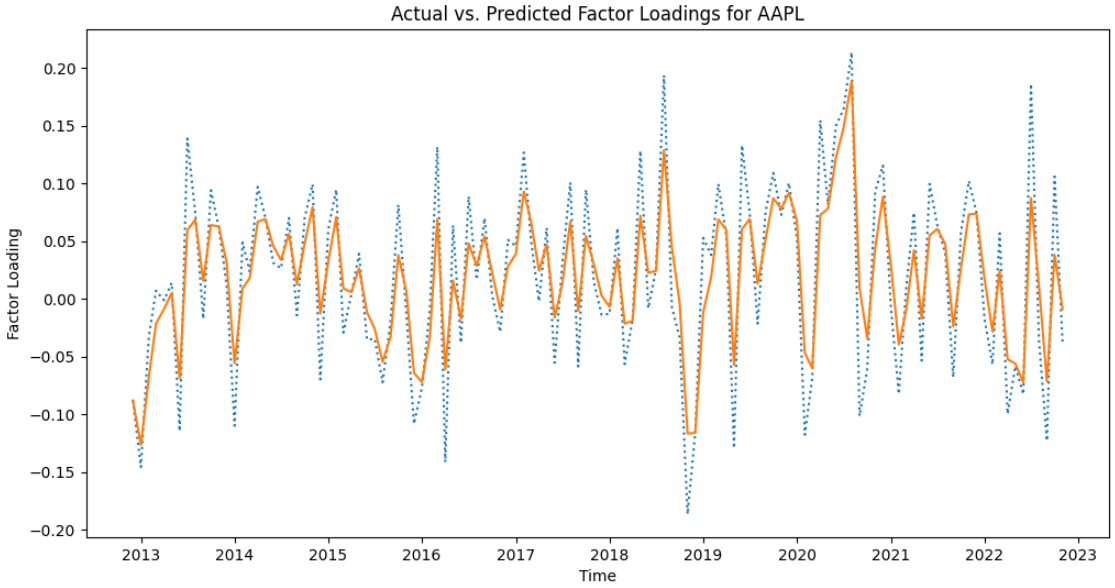
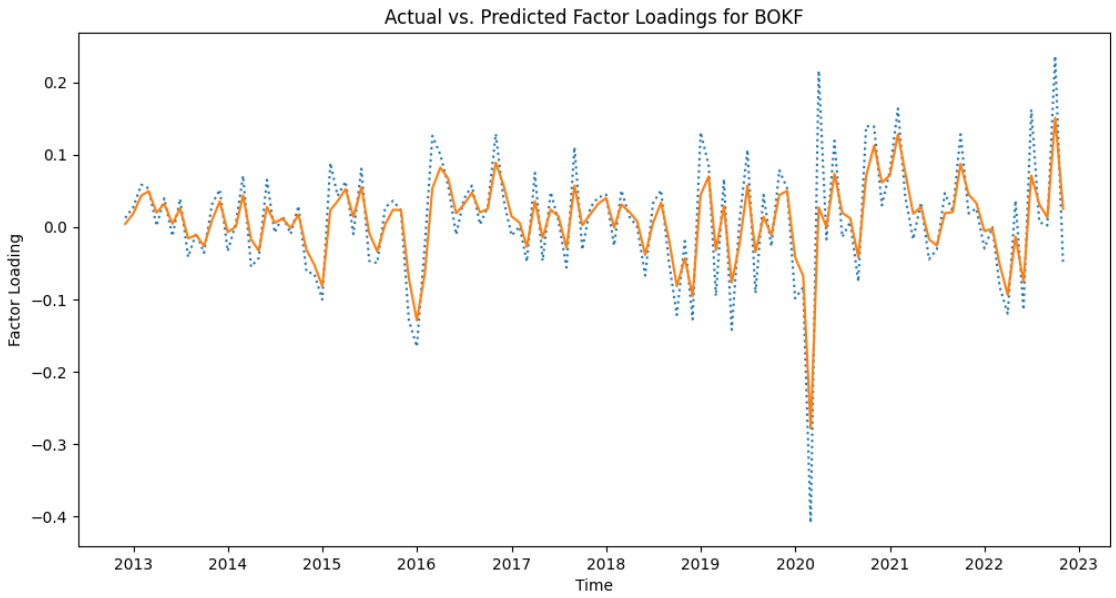
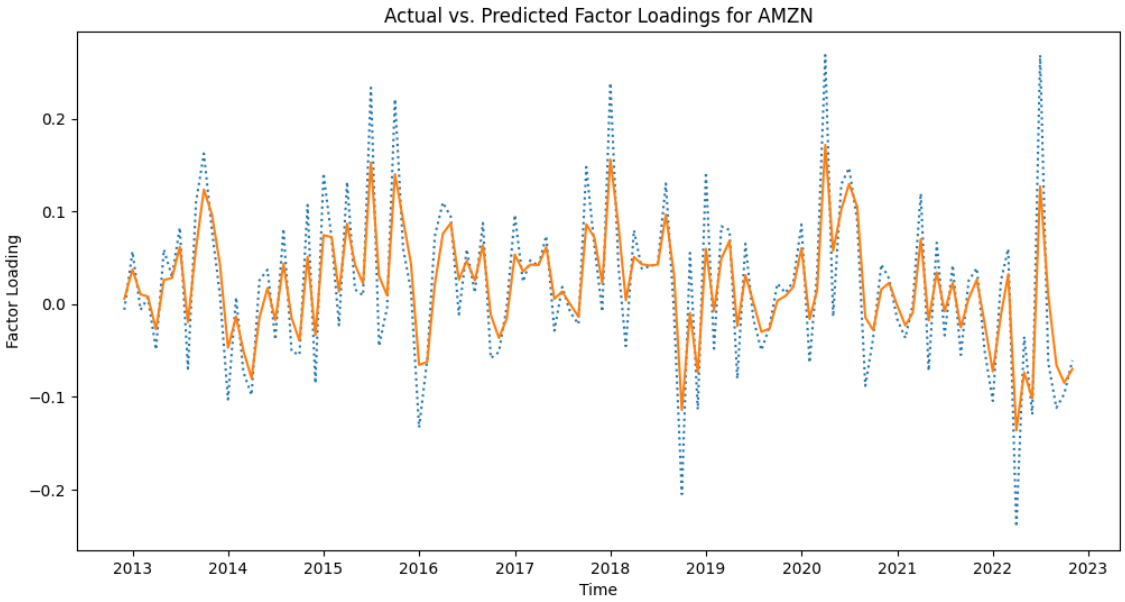
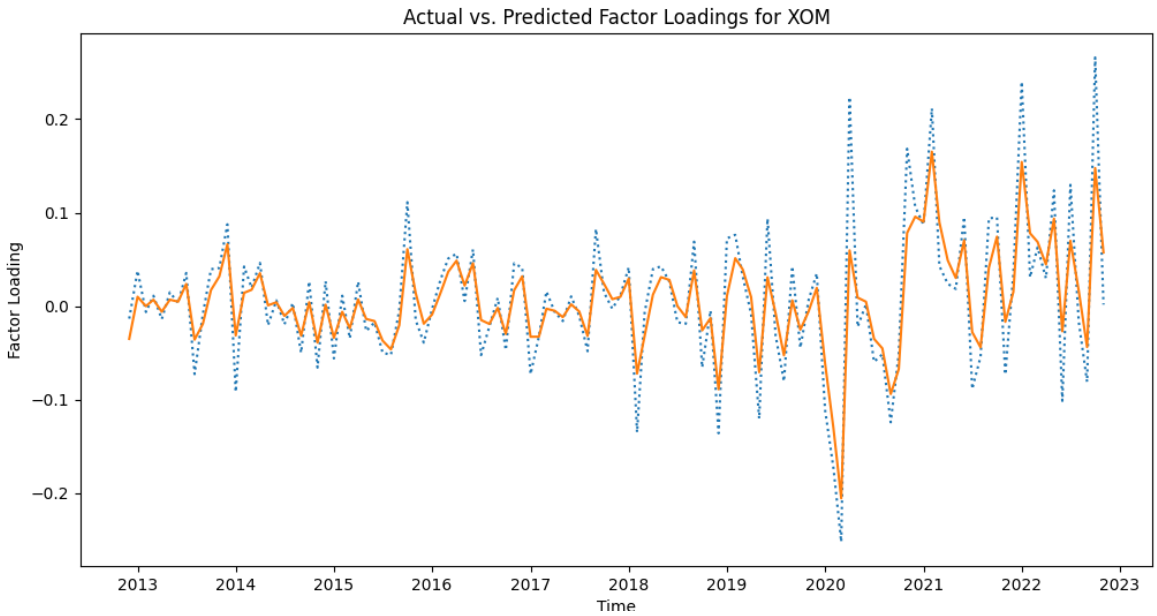
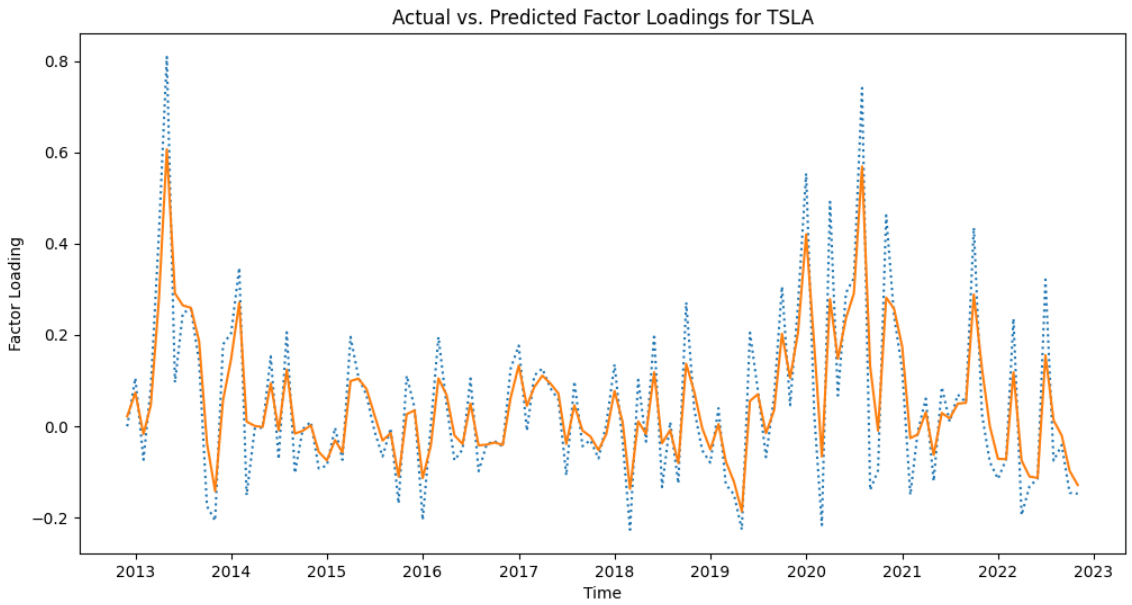
RMSE for Rolling Fixed 60-month Estimation Window (OLS):
             OLS
AAPL    0.050026
BOKF    0.060933
AMZN    0.059329
XOM     0.061833
TSLA    0.142788
^SPX         0.0
RMSE for Cumulative Rolling Estimation Window (OLS):
             OLS
AAPL    0.049777
BOKF    0.059545
AMZN     0.05886
XOM     0.061331
TSLA    0.141882
^SPX         0.0
```


Actual vs. Predicted Factor Loadings for AAPL
Factor Loading
Time
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023


Actual vs. Predicted Factor Loadings for BOKF
Factor Loading
Time
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023


Actual vs. Predicted Factor Loadings for AMZN
Factor Loading
0.2
0.1
0.0
−0.1
−0.2
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Time


Actual vs. Predicted Factor Loadings for XOM
Factor Loading
0.2
0.1
0.0
−0.1
−0.2
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Time


Actual vs. Predicted Factor Loadings for TSLA
Factor Loading
0.8
0.6
0.4
0.2
0.0
−0.2
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Time