Elliot Delahaye, Awaid Yasin, Sam Piazza, Christian Pavilanis

HW 3

a. CAPM Returns Forecast

Q1	-0.42617
Q2	-0.18258
Q3	-0.08591
Q4	0.000139

Fama-French Returns Forecast

	Severe	Baseline
2021Q1	0.070623	0.152080
2021Q2	0.072581	0.159842
2021Q3	0.080437	0.162335
2021Q4	0.092649	0.164321

GMFM Returns Forecast

	Severe	Baseline
0	-0.016775	0.054936
1	-0.004351	0.054936
2	0.000484	0.054936
3	0.010234	0.054936

b.

1.
2. Goodness of Fits
   CAPM: R2 for each stock (in order of appearance)

	R2
1	0.122904
2	0.297812
3	0.221516
4	0.318267
5	0.327948
6	0.429594
7	0.587356
8	0.559149
9	0.42964
10	0.562457
11	0.170926
12	0.308525
13	0.341906

14	0.233241
15	0.225869
16	0.311974
17	0.421333
18	0.253606
19	0.194364
20	0.263168

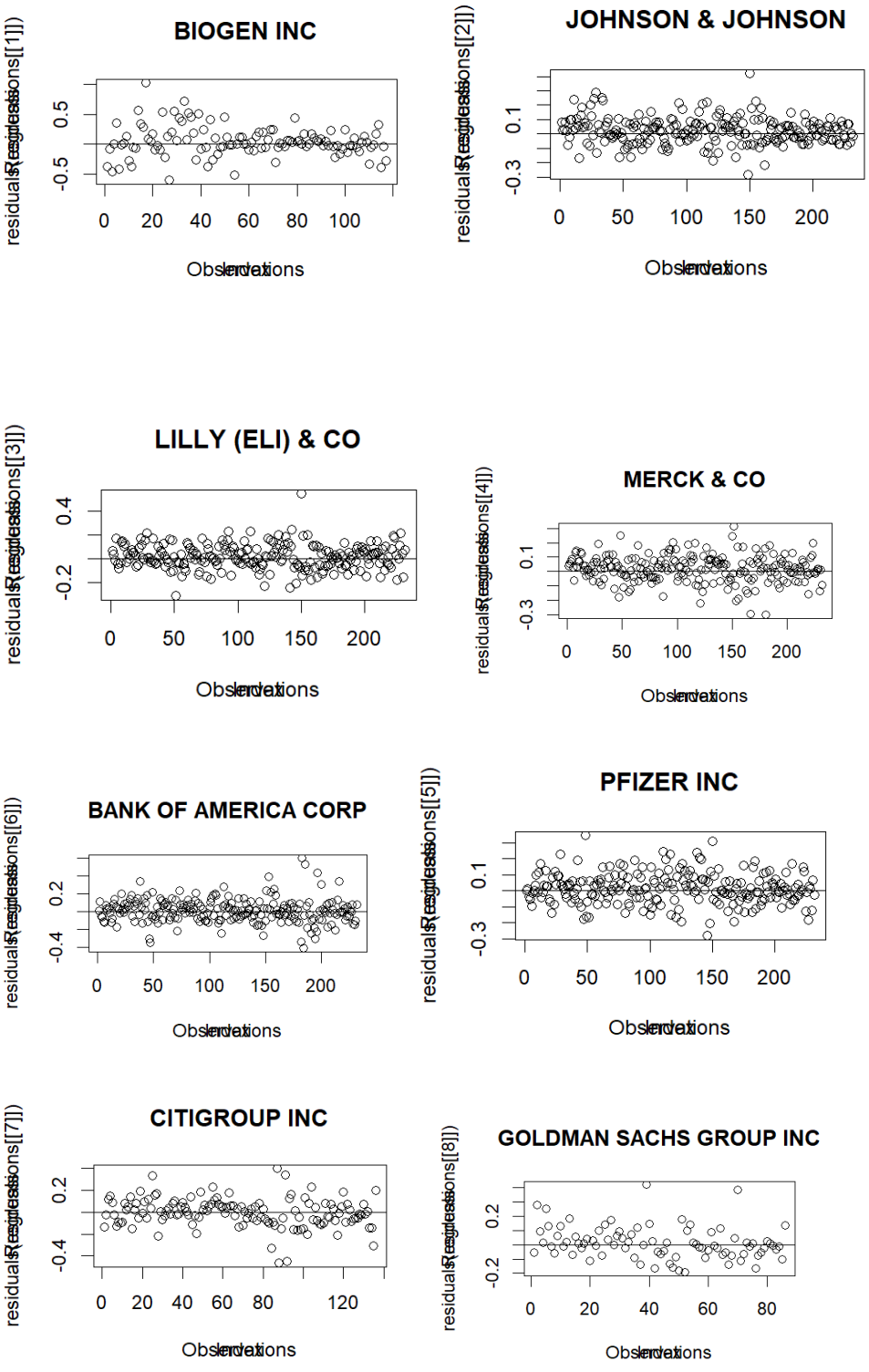
Fama-French 3 Factor Model (in order of appearance)

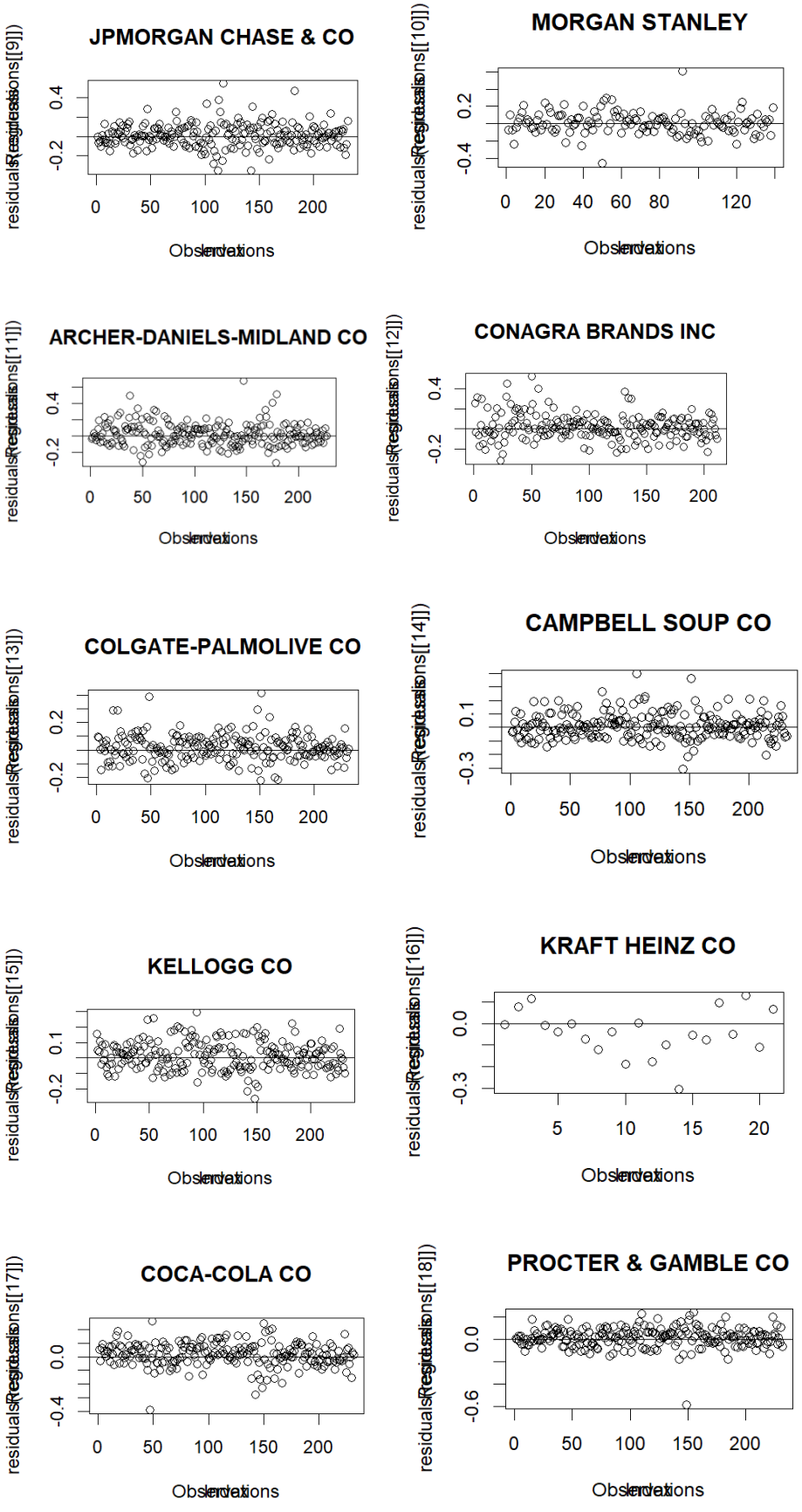
	R2
1	0.1507
2	0.3128
3	0.2413
4	0.3835
5	0.3571
6	0.5218
7	0.6717
8	0.5602
9	0.5354
10	0.5642
11	0.1616
12	0.3172
13	0.3407
14	0.2447
15	0.2446
16	0.371
17	0.4249
18	0.3001
19	0.2227
20	0.3054

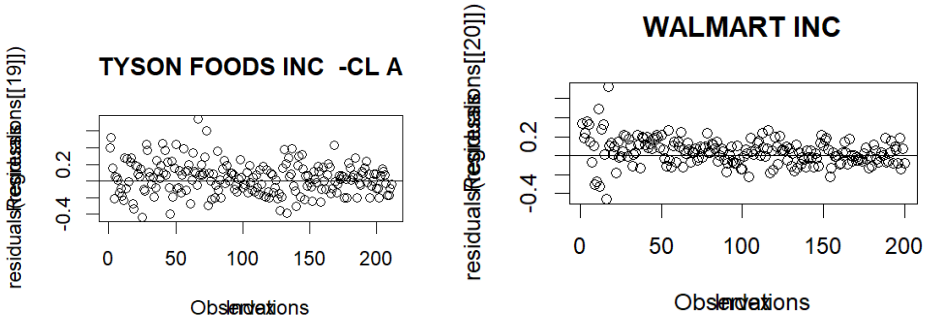
Multi-Factor Model

0.314

3. CAPM

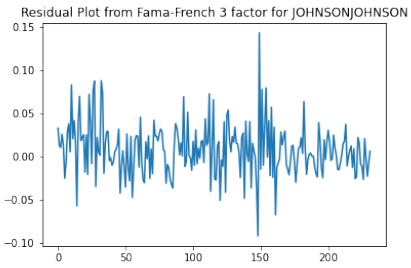

BIOGEN INC
JOHNSON & JOHNSON
LILLY (ELI) & CO
MERCK & CO
BANK OF AMERICA CORP
PFIZER INC
CITIGROUP INC
GOLDMAN SACHS GROUP INC

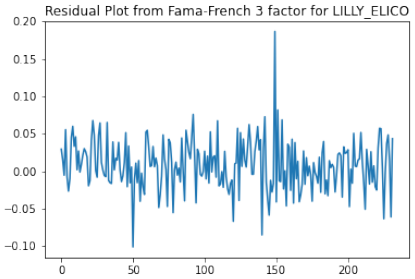

JPMORGAN CHASE & CO
MORGAN STANLEY
ARCHER-DANIELS-MIDLAND CO
CONAGRA BRANDS INC
COLGATE-PALMOLIVE CO
CAMPBELL SOUP CO
KELLOGG CO
KRAFT HEINZ CO
COCA-COLA CO
PROCTER & GAMBLE CO
Observation Index

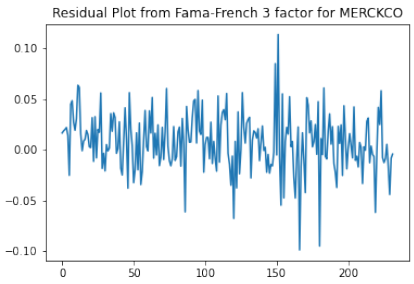


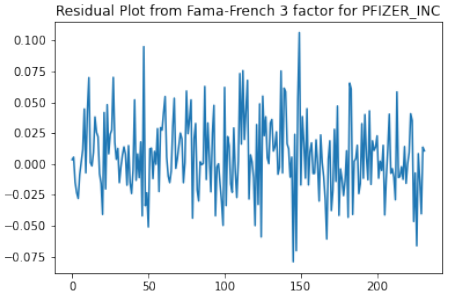
Broadly the residuals show no sign of autocorrelation or heteroskedasticity.

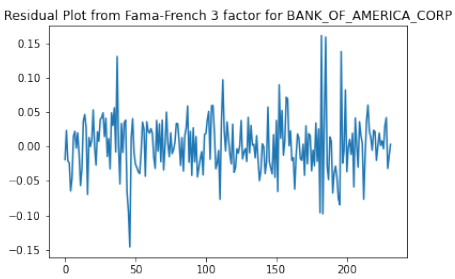
Fama-French 3FM

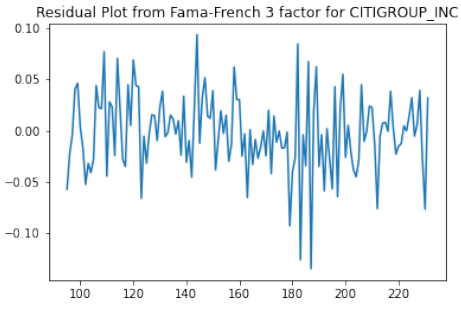


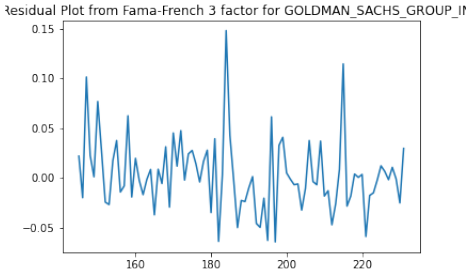


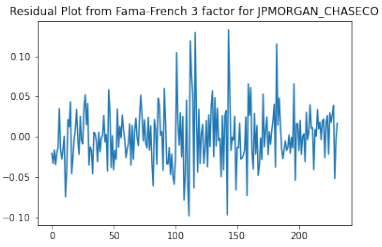












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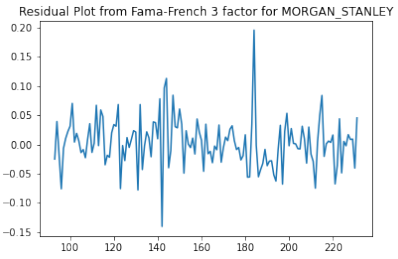
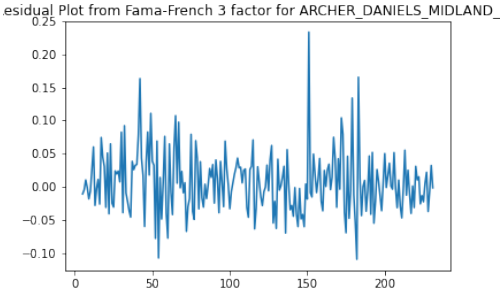
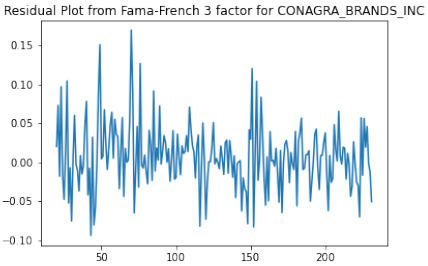
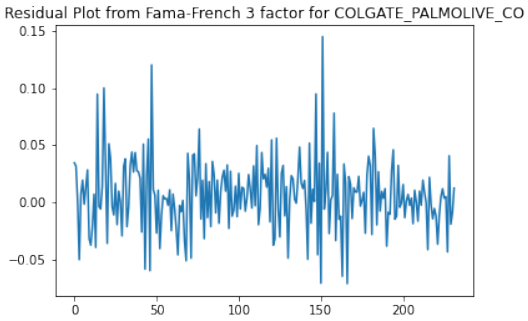
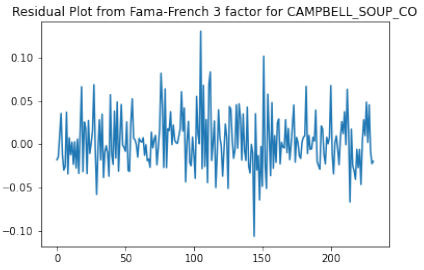
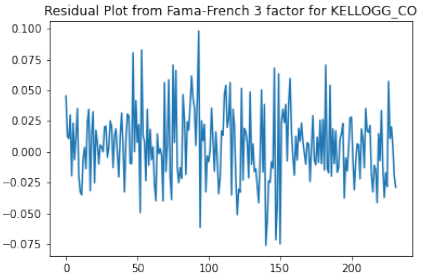


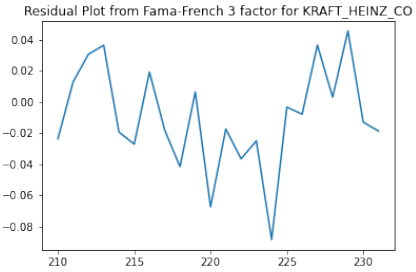


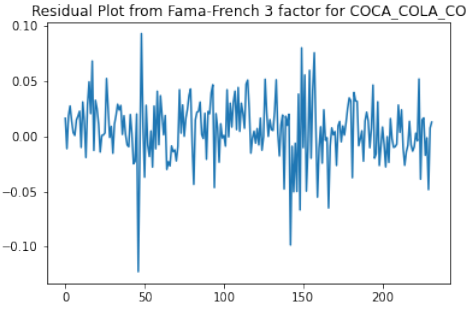


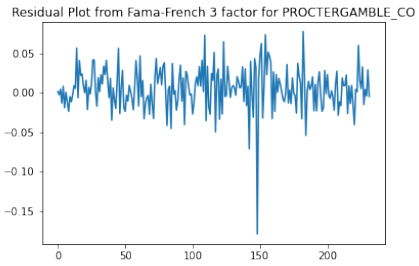


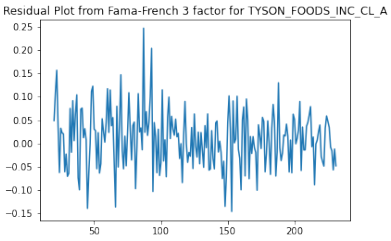


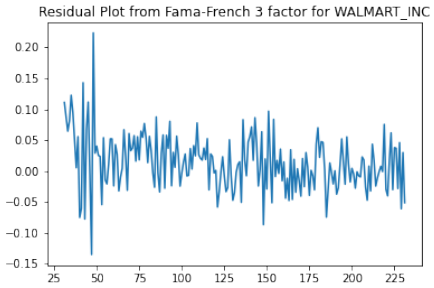






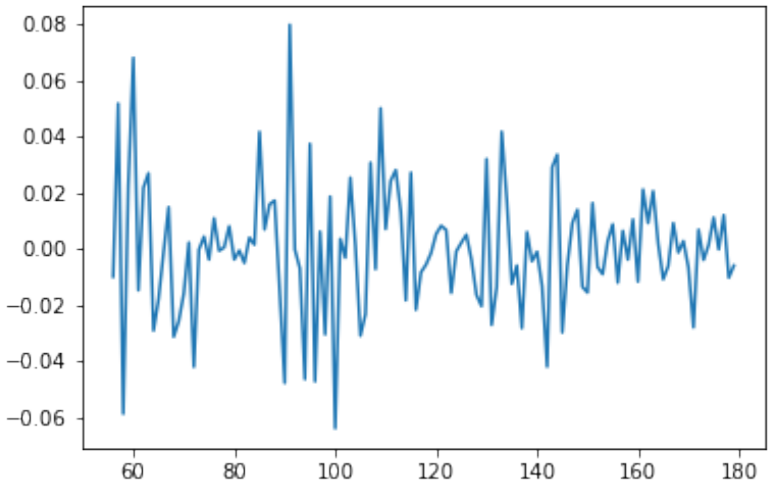






Broadly the residuals show no sign of autocorrelation or heteroskedasticity.

GFM



Broadly the residuals show no sign of autocorrelation or heteroskedasticity.

c.

1. We run stock-by-stock estimation of Fama-French 3 factor model to get β coefficients. We utilize the maximum available period for each stock to get better coverage.
2. Fama-French method would proceed in two steps. First, I estimate the 3-factor model for each stock. Then, I regress each of those three factors on historical MEVs. Using the scenario values for those MEVs, then, I forecast the factors and eventually the returns. In sum, there are two regressions (one corresponding to each step). In the first classic 3-factor regression, we get an adjusted-R squared of around ~0.30. The R-squared for the 2nd-step regression is higher and around ~0.40. I use heteroskedasticity and autocorrelation-adjusted (HAC) standard errors.
3. The forecasted portfolio return is lower under the 'Severe' scenario and high under the 'Baseline' scenario. This result is both intuitive and according to expectations.

4. β coefficients should be estimated using data on both the 'normal' and 'stress' periods. The reason is as follows: using one specific state of the business cycle (i.e., boom or bust) for estimation would wrongfully capture the effect of macroeconomic shocks and label them as the effect of systemic risk, and hence generating an estimate of β that is specific to that time period. It is, hence, desirable to use both periods and make use of all the variation in the data to estimate the true β.
5. The Fama-French model is balanced when it comes to complexity and interpretability. It uses a theoretical structure (Fama-French factors) and links it back to fluctuations in the macroeconomy. CAPM, arguably, is too simple and the 'general factor model' is theory-less (a pure reduced-form structure). Fama-French (with MEVs) model seems to be a decent balance between theory and forecasting using MEVs.
6. Model performance would be equally affected by noise and bias in the data. Under high bias, the projected average portfolio returns would be far away from the 'true' returns. While more noise may give us the true projections, but the standard errors are going to be too large to make any confident/reliable statement.
7. CAPM seems to be more sensitive to the law of small numbers simply because the returns are modelled as a function of two variables. Hence, any change in those variables would change the projections by a lot. Multi-factor regression, on the other hand, models stock returns as a function of a _number_ of macroeconomic variables, making it robust to changes in any one variable.
8. Model selection is an important part of stress testing. In the end what matters is the _out-of-sample_ performance of a forecasting model (not part of this assignment). So, a model could have robust in-sample forecasts, but could miserably fail when it comes to out-of-sample forecasts. Therefore, choosing the 'best' model needs to incorporate some kind of out-of-sample evaluation.
9. The residual plots from Fama-French 3 factor model are more or less stable and stationary (i.e., the residuals have an average of 0 and oscillate around mean zero). This re-ensures that we don't have a potential model misspecification.

d. <u>CAPM</u>

Q1	0.004689
Q2	0.004889
Q3	0.005103
Q4	0.005257

<u>Fama-French</u>
See part a

<u>GFM</u>
See part a