Stock Prediction and Time Series Model Comparisons

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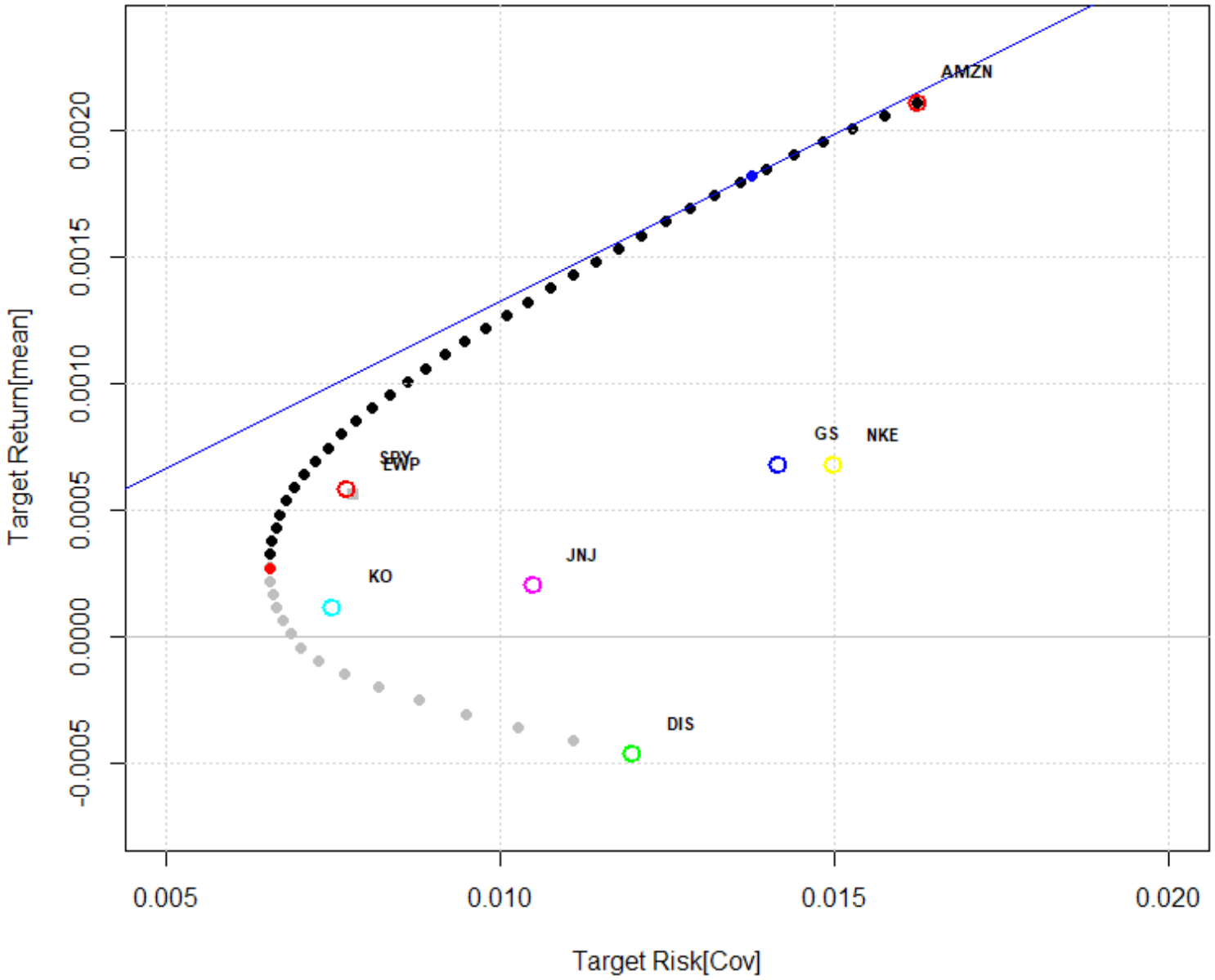
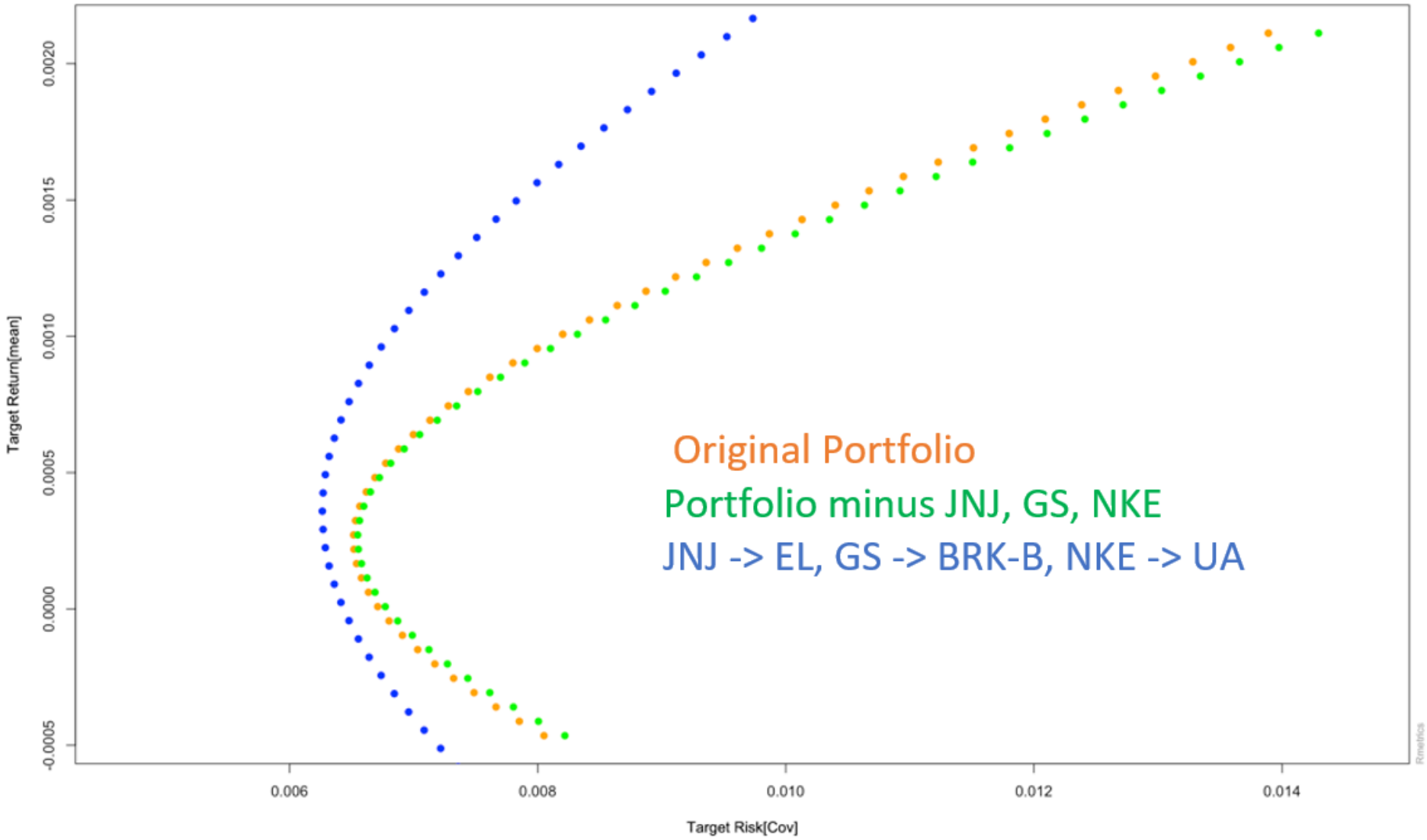
Dataset

- Daily returns from *quantmod*
- Started with 6 different industries
- Chose 3 stocks from each industry and picked highest efficiency
- Nike, Disney, Coca Cola, Johnson & Johnson, Amazon, and Goldman Sachs
- Added SPY for more balance

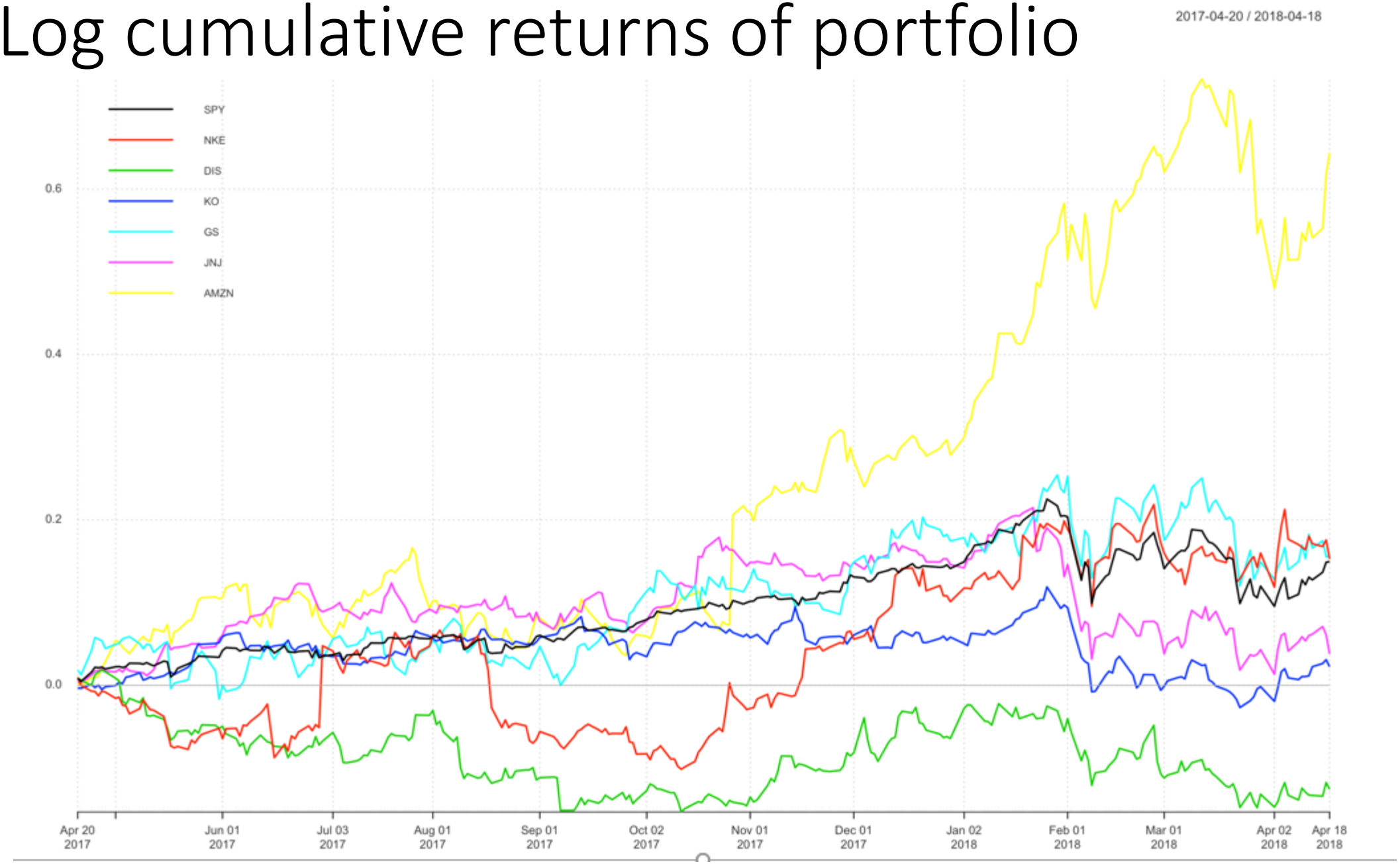
The tailored efficiency frontier



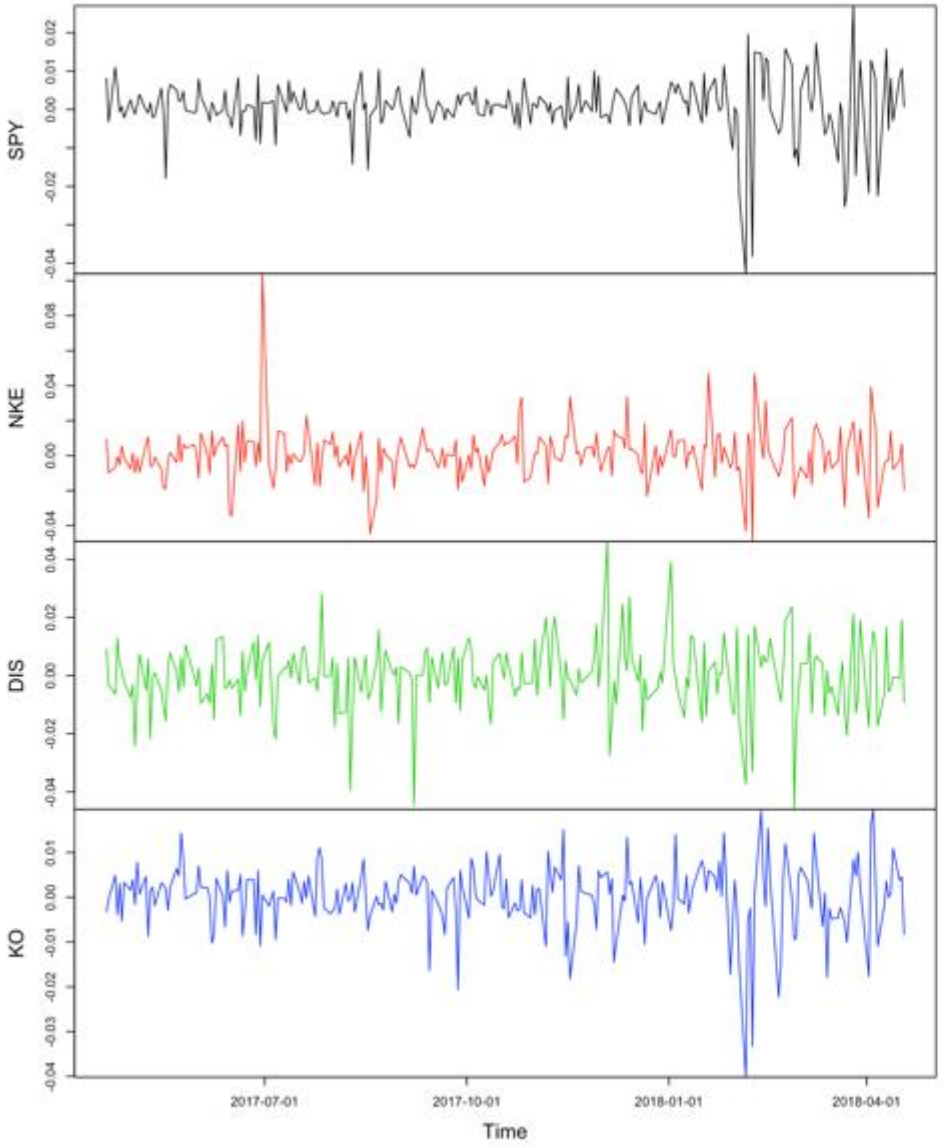
Portfolio optimizations

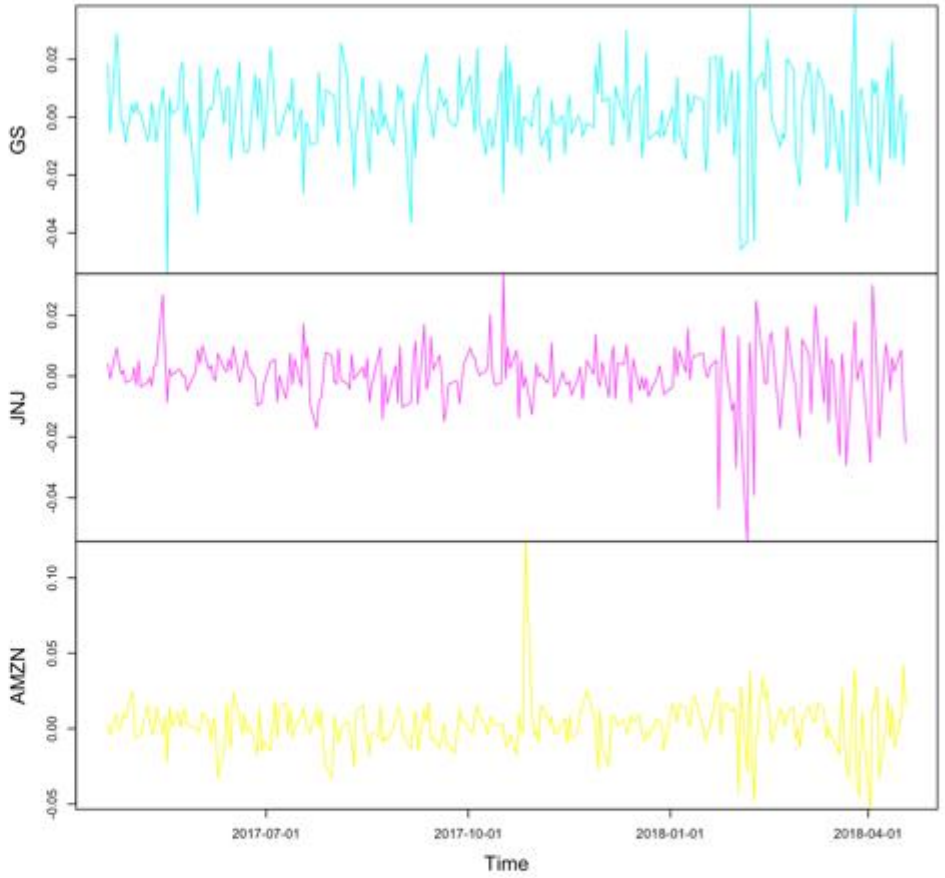


Log cumulative returns of portfolio



Returns of each individually





We know there is a time component, and visually it seems as though there may be one.

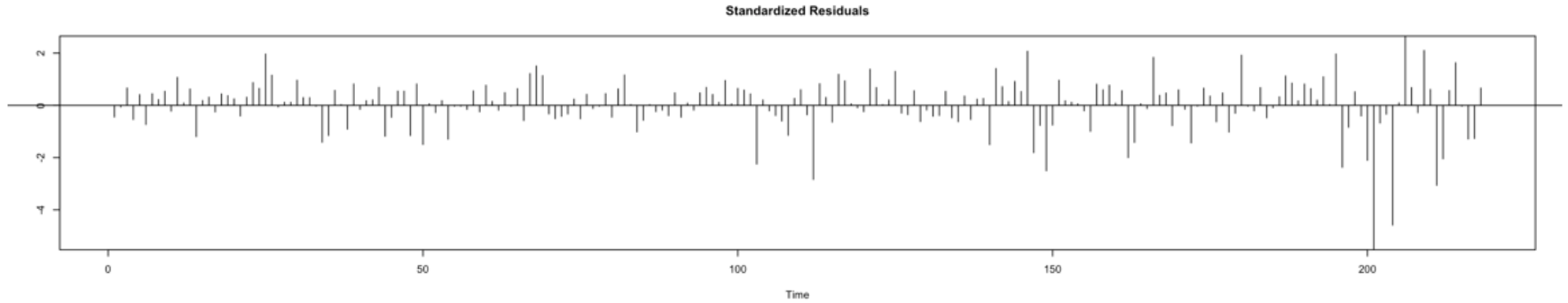
However, every *auto.arima()* chose ARIMA(0,0,0) with zero mean

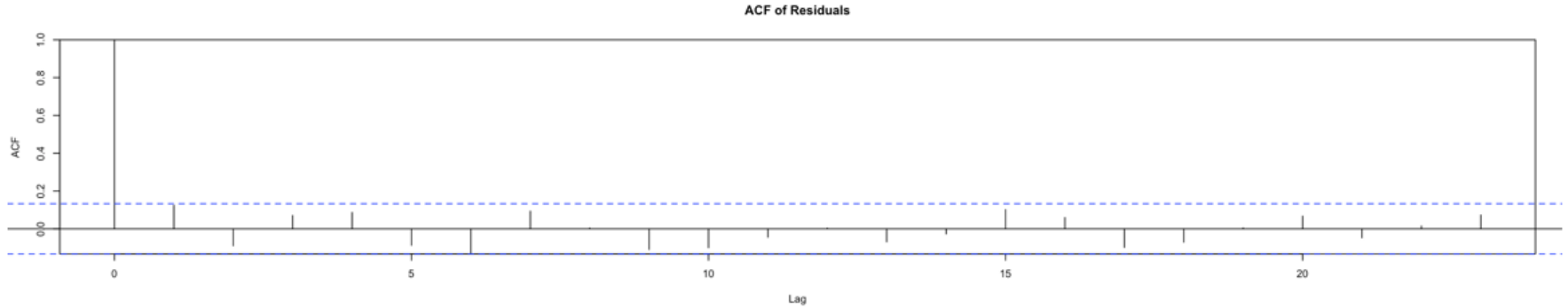
Zooming in on KO – most average stock

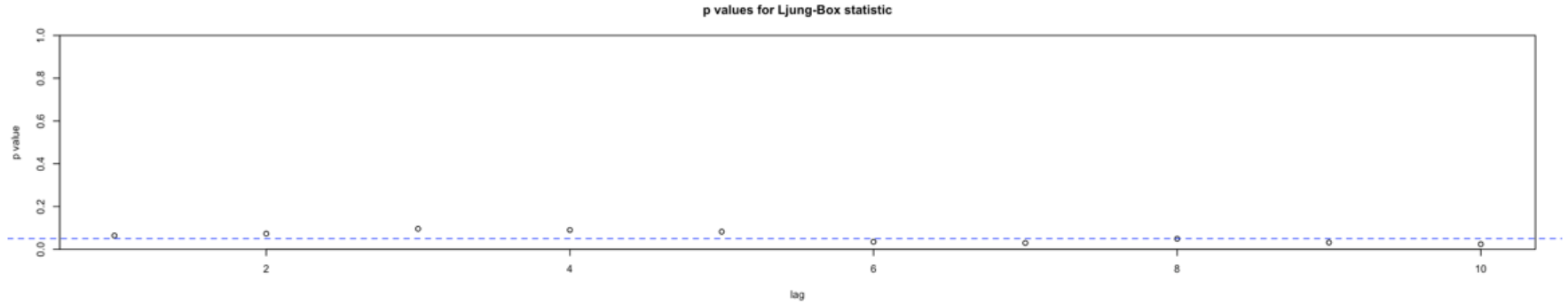
Matches same pattern as returns

Strong first lag, everything else looks fine

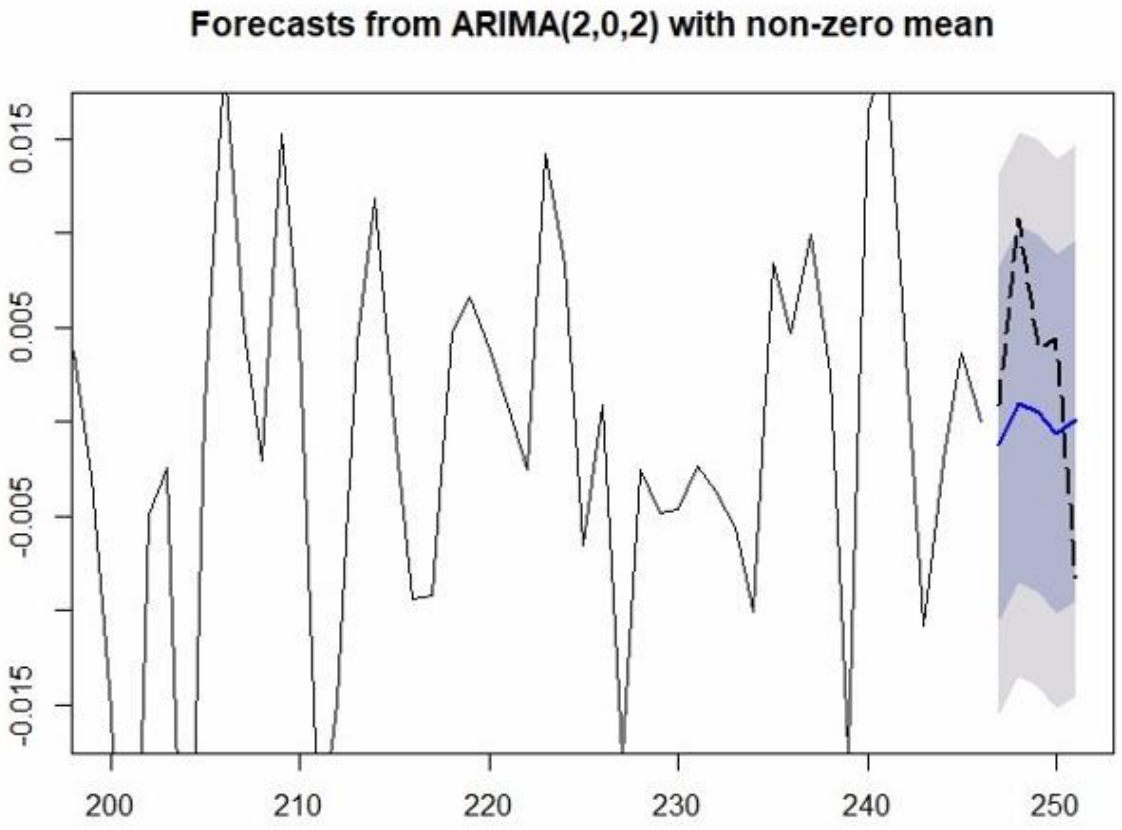
Ljung-Box p-values very close to 0.05 line, no concerns with randomness



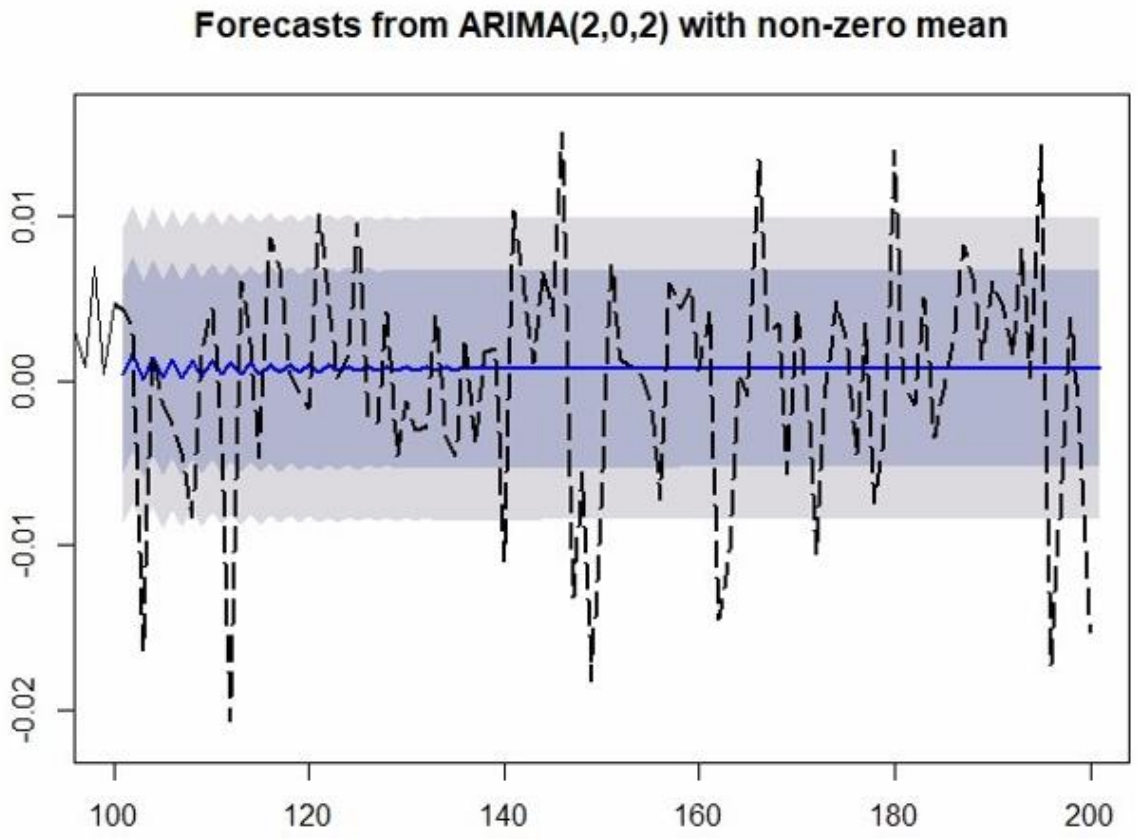




ARIMA and Back-test for KO



ARIMA forecast 5 days out



ARIMA back-test

GARCH Fit & Five Day Forecast

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Conditional Variance Dynamics
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GARCH Model     : sGARCH(1,1)
Mean Model      : ARFIMA(0,0,0)
Distribution    : norm

Optimal Parameters
------------------------------------
        Estimate  Std. Error  t value Pr(>|t|)
mu      0.000236    0.000391  0.60394 0.545882
omega   0.000005    0.000001  3.91773 0.000089
alpha1  0.175256    0.039932  4.38887 0.000011
beta1   0.745185    0.046773 15.93184 0.000000

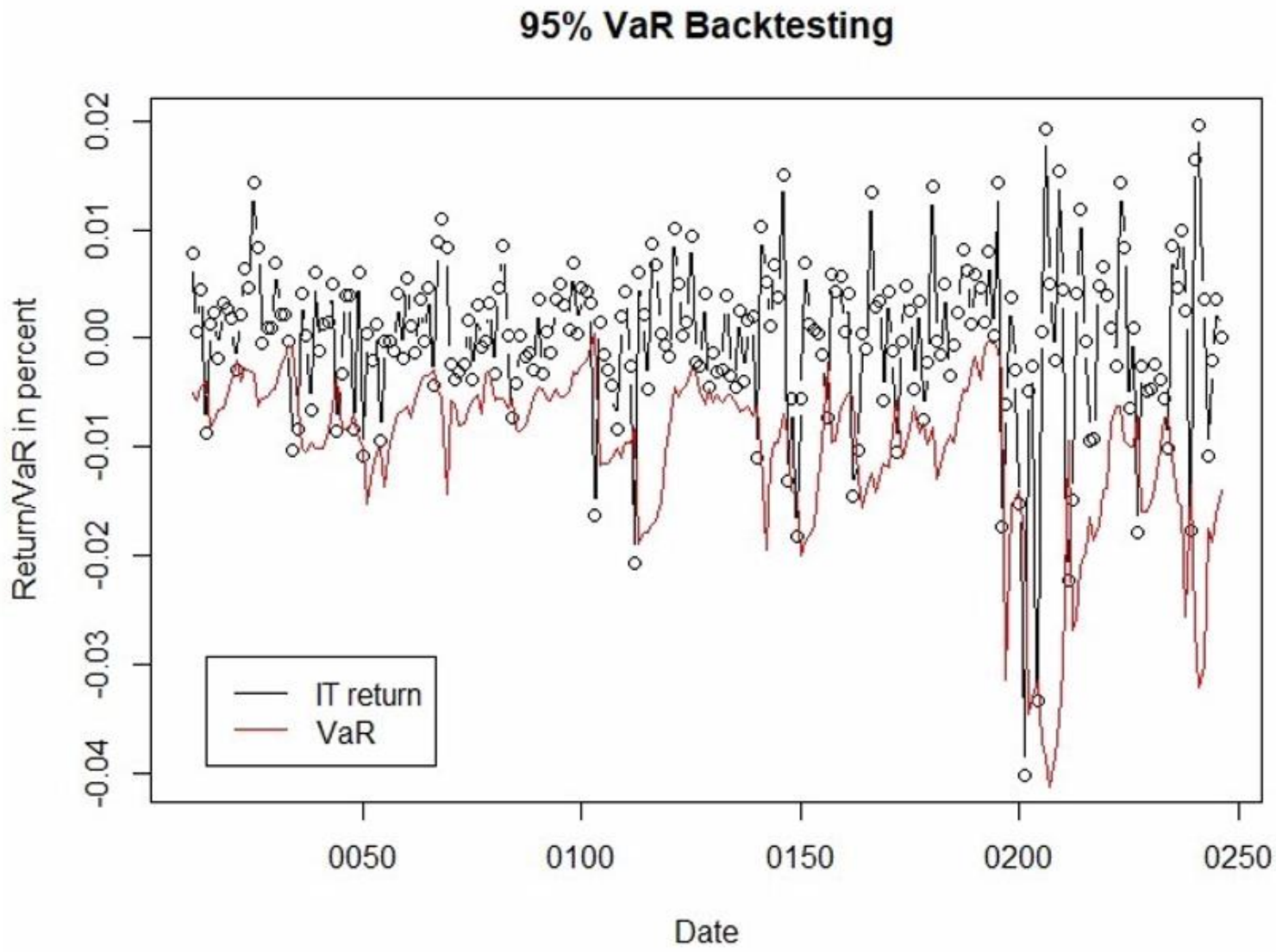
Robust Standard Errors:
        Estimate  Std. Error  t value Pr(>|t|)
mu      0.000236    0.000421  0.56153 0.574434
omega   0.000005    0.000002  2.37317 0.017636
alpha1  0.175256    0.032120  5.45631 0.000000
beta1   0.745185    0.054439 13.68841 0.000000

LogLikelihood : 784.6324
```

```
Model: sGARCH
Horizon: 5
Roll Steps: 0
Out of Sample: 0

0-roll forecast [T0=2018-03-01]:
       Series    Sigma
T+1 0.0002362 0.008931
T+2 0.0002362 0.008839
T+3 0.0002362 0.008754
T+4 0.0002362 0.008675
T+5 0.0002362 0.008602
```

GARCH Back-testing



Our model is conservative

Under-predicts the returns most of the time

ARIMA vs GARCH

RMSE	SPY	UA	DIS	BRKB	EL	KO	AMZN
ARIMA	0.0073	0.0320	0.0117	0.0104	0.0118	0.0073	0.0160
GARCH	0.0065	0.0224	0.0098	0.0074	0.0127	0.0066	0.0211