STATS 415 Final Project

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2.3 Linear Regression

```
final_project <- read_csv("data/final_project-1.csv")
```

```
## Warning: Missing column names filled in: 'X1' [1]
```

```
##
## -- Column specification --------------------------------------------------------
## cols(
##   X1 = col_double(),
##   Asset_1 = col_double(),
##   Asset_2 = col_double(),
##   Asset_3 = col_double()
## )
```

```
# Removing the index column
final_project <- final_project %>% select(Asset_1:Asset_3)
Asset_1 <- final_project %>% select(Asset_1)
df <- read.csv("output/bret.csv")
Asset_1_lead <- lead(Asset_1, n=10, default=tail(Asset_1, 1))
Asset_1_HRet_10 <- (Asset_1_lead - Asset_1) / Asset_1
colnames(Asset_1_HRet_10) <- c("Asset_1_HRet_10")
df <- cbind(df, Asset_1_HRet_10)

train_size <- floor(nrow(df) * 0.7)
test_size <- nrow(df) - train_size

train_set <- head(df, train_size)
test_set <- tail(df, test_size)

lr_modl <- lm(Asset_1_HRet_10 ~ ., data=train_set)
summary(lr_modl)
```

```
##
## Call:
## lm(formula = Asset_1_HRet_10 ~ ., data = train_set)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
```

```
## -0.147289 -0.000919  0.000010  0.000928  0.085484
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)     -1.036e-05  4.758e-06  -2.178 0.029412 *
## Asset_1_BRet_3   4.071e-02  4.076e-03   9.987  < 2e-16 ***
## Asset_1_BRet_10  1.706e-02  2.537e-03   6.725 1.75e-11 ***
## Asset_1_BRet_30  6.268e-03  1.261e-03   4.972 6.63e-07 ***
## Asset_2_BRet_3   2.593e-02  2.228e-03  11.636  < 2e-16 ***
## Asset_2_BRet_10 -5.400e-03  1.435e-03  -3.764 0.000168 ***
## Asset_2_BRet_30  8.880e-03  7.609e-04  11.672  < 2e-16 ***
## Asset_3_BRet_3   1.835e-02  2.247e-03   8.167 3.17e-16 ***
## Asset_3_BRet_10  3.429e-03  1.441e-03   2.379 0.017359 *
## Asset_3_BRet_30 -9.689e-04  7.295e-04  -1.328 0.184138
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.002882 on 366902 degrees of freedom
## Multiple R-squared:  0.004606,   Adjusted R-squared:  0.004581
## F-statistic: 188.6 on 9 and 366902 DF,  p-value: < 2.2e-16
```

It seems that the 3, 10, and 30 minutes backward returns of Asset 2 and the 3 minutes backward return of Asset 3 are important in predicting the forward return of Asset 1.

```
train_pred <- predict.lm(lr_modl, train_set)
test_pred <- predict.lm(lr_modl, test_set)

# In-sample correlation
cor(as.matrix(cbind(train_pred, train_set$Asset_1_HRet_10)))
```

```
##            train_pred
## train_pred 1.00000000 0.06786533
##            0.06786533 1.00000000
```

```
sprintf("The in-sample correlation is %s",
        cor(as.matrix(cbind(train_pred, train_set$Asset_1_HRet_10)))[[2,1]])
```

```
## [1] "The in-sample correlation is 0.0678653324781759"
```

```
# Out-sample correlation
cor(as.matrix(cbind(test_pred, test_set$Asset_1_HRet_10)))
```

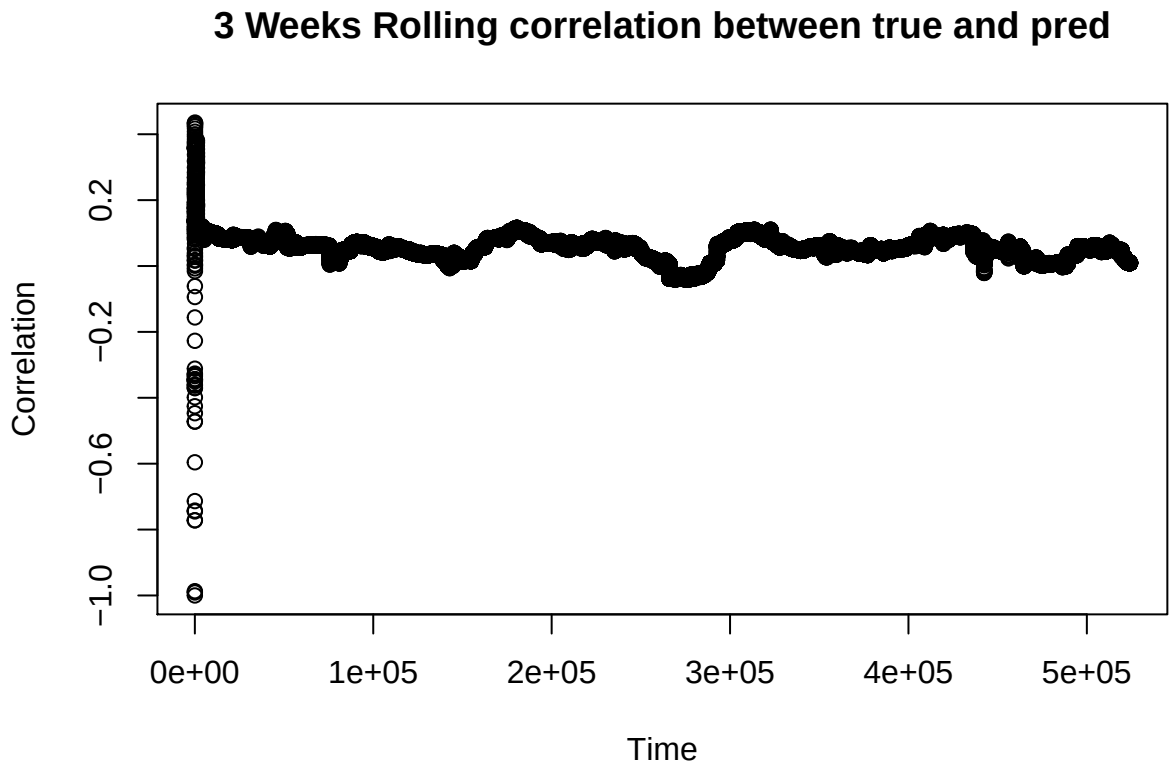
```
##            test_pred
## test_pred 1.00000000 0.04068153
##           0.04068153 1.00000000
```

```
sprintf("The out-sample correlation is %s",
        cor(as.matrix(cbind(test_pred, test_set$Asset_1_HRet_10)))[[2,1]])
```

```
## [1] "The out-sample correlation is 0.04068153274835"
```

```r
train_pred <- data.frame(train_pred)
test_pred <- data.frame(test_pred)
colnames(train_pred) <- c("Asset_1_HRet_10_pred")
colnames(test_pred) <- c("Asset_1_HRet_10_pred")
Asset_1_HRet_10_lead <- rbind(train_pred, test_pred)
df <- cbind(df, Asset_1_HRet_10_lead)

# 3 Weeks Rolling correlation
for (i in 1:nrow(df)) {
  start = max(i - 30240, 1)
  df$Rho[i] = cor(df$Asset_1_HRet_10[start:i], df$Asset_1_HRet_10_pred[start:i])
}
plot(df$Rho, xlab="Time", ylab="Correlation",
     main="3 Weeks Rolling correlation between true and pred")
```



This correlation structure is unstable near the beginning of the year but is relatively stationary for the year. There are some fluctuations but the correlation seem to stay between 0 and 0.1.