Project

March 22, 2019

```
In [29]: library(tidyverse)
```

```
In [30]: average_returns=read_csv("Average Value Weighted Returns -- Monthly.csv")
         factor_returns=read_csv("Factor Returns.csv")
```

```
Parsed with column specification:
cols(
  YearMonth = col_integer(),
  Manuf = col_double(),
  HiTec = col_double(),
  Utils = col_double(),
  RF = col_double()
)
Parsed with column specification:
cols(
  `Mkt-RF` = col_double(),
  SMB = col_double(),
  HML = col_double()
)
```

```
In [31]: head(average_returns)
```

YearMonth	Manuf	HiTec	Utils	RF
198001	7.02	7.37	1.60	0.80
198002	-2.65	-3.56	-3.36	0.89
198003	-11.68	-12.67	-6.67	1.21
198004	3.25	0.72	11.96	1.26
198005	6.18	4.82	4.61	0.81
198006	2.41	3.03	4.54	0.61

```
In [32]: head(factor_returns)
```

Mkt-RF	SMB	HML
5.51	1.65	1.80
-1.22	-1.82	0.62
-12.90	-6.64	-1.06
3.97	0.97	1.06
5.26	2.16	0.39
3.06	1.67	-0.89

```
In [33]: average_returns = average_returns %>% mutate(`Mkt-RF`=factor_returns$`Mkt-RF`)
         average_returns = average_returns %>% mutate(`SMB`=factor_returns$`SMB`)
         average_returns = average_returns %>% mutate(`HML`=factor_returns$`HML`)

         head(average_returns)
```

YearMonth	Manuf	HiTec	Utils	RF	Mkt-RF	SMB	HML
198001	7.02	7.37	1.60	0.80	5.51	1.65	1.80
198002	-2.65	-3.56	-3.36	0.89	-1.22	-1.82	0.62
198003	-11.68	-12.67	-6.67	1.21	-12.90	-6.64	-1.06
198004	3.25	0.72	11.96	1.26	3.97	0.97	1.06
198005	6.18	4.82	4.61	0.81	5.26	2.16	0.39
198006	2.41	3.03	4.54	0.61	3.06	1.67	-0.89

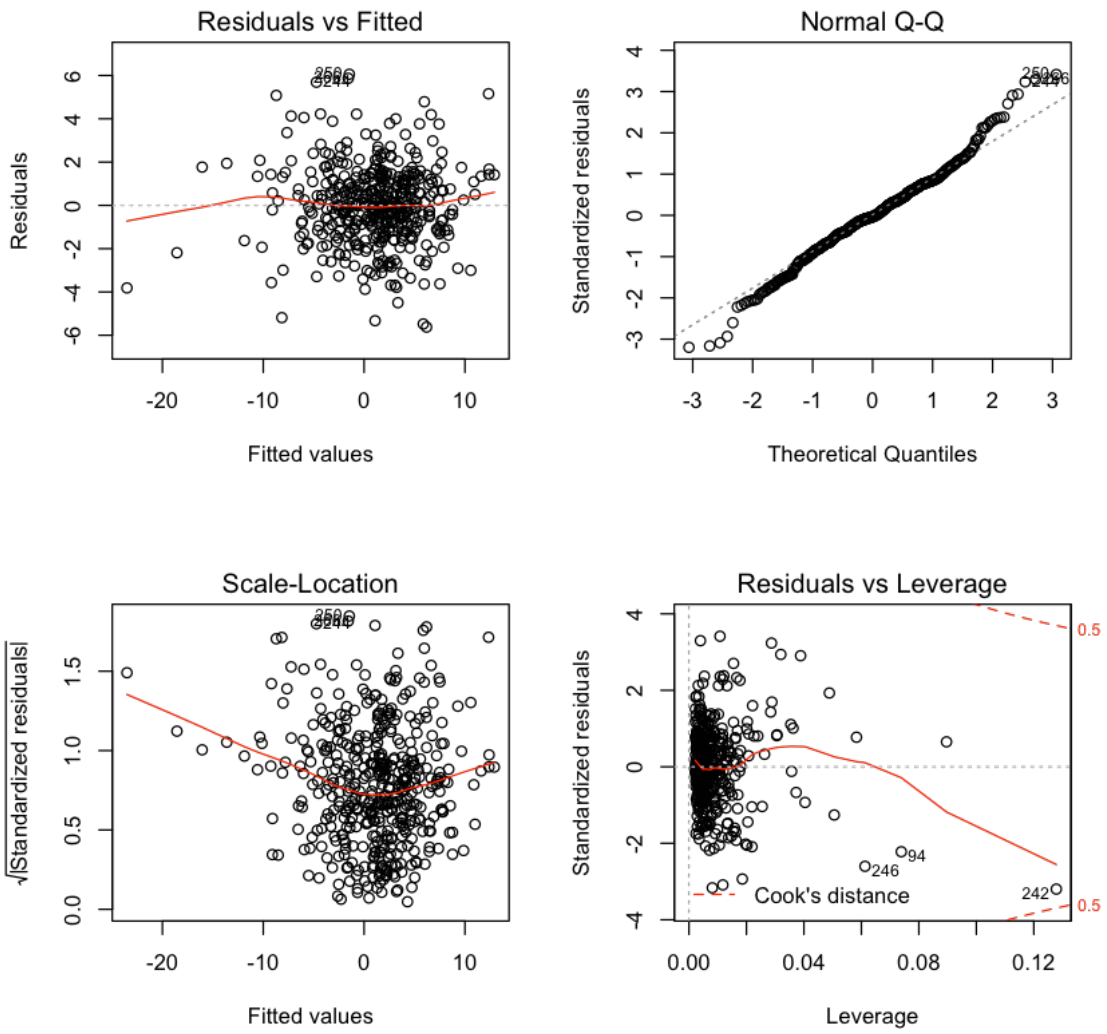
```
In [34]: lmod=lm(`Manuf` ~ `Mkt-RF`+`SMB`+`HML`, data = average_returns)
         summary(lmod)
         par(mfrow = c(2,2)); plot(lmod)
```

```
Call:
lm(formula = Manuf ~ `Mkt-RF` + SMB + HML, data = average_returns)

Residuals:
    Min      1Q  Median      3Q     Max
-5.6231 -1.0378 -0.0566  1.0972  6.0570

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.351963   0.085412   4.121 4.49e-05 ***
`Mkt-RF`    1.061538   0.020032  52.993  < 2e-16 ***
SMB         0.008925   0.029208   0.306     0.76
HML         0.207324   0.030273   6.848 2.45e-11 ***
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1

Residual standard error: 1.784 on 452 degrees of freedom
Multiple R-squared:  0.8674,Adjusted R-squared:  0.8665
F-statistic: 985.6 on 3 and 452 DF,  p-value: < 2.2e-16
```




```
In [35]: lmod1=lm(`HiTec` ~ `Mkt-RF`+`SMB`+`HML`, data = average_returns)
         summary(lmod1)
         par(mfrow = c(2,2)); plot(lmod1)
```

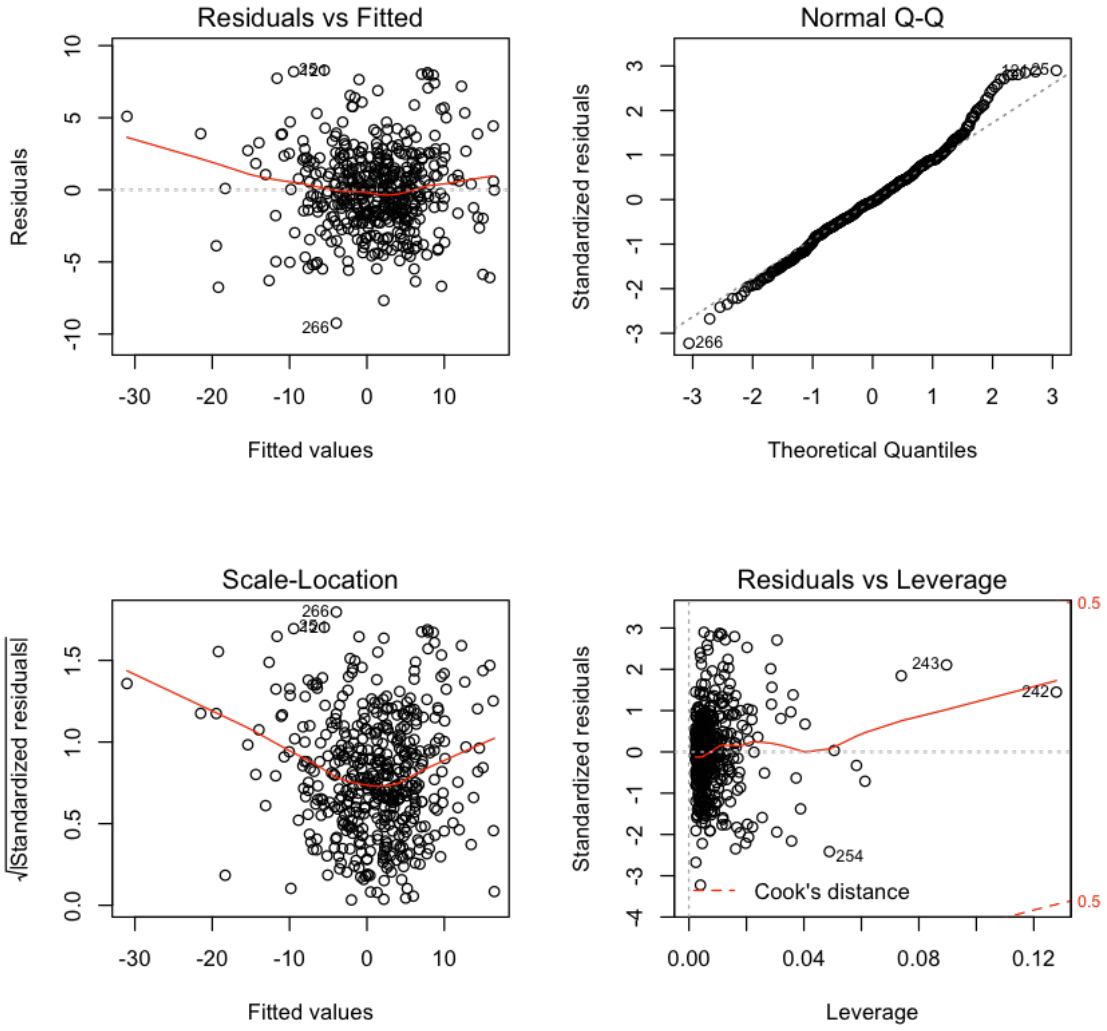
```
Call:
lm(formula = HiTec ~ `Mkt-RF` + SMB + HML, data = average_returns)

Residuals:
    Min      1Q  Median      3Q     Max
-9.2395 -1.7404 -0.1014  1.6254  8.2940

Coefficients:
```

```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.46785    0.13741   3.405 0.000721 ***
`Mkt-RF`     1.16175    0.03223  36.050  < 2e-16 ***
SMB          0.22857    0.04699   4.864 1.59e-06 ***
HML         -0.60659    0.04870 -12.455  < 2e-16 ***
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1

Residual standard error: 2.87 on 452 degrees of freedom
Multiple R-squared:  0.8193,Adjusted R-squared:  0.8181
F-statistic:   683 on 3 and 452 DF,  p-value: < 2.2e-16
```



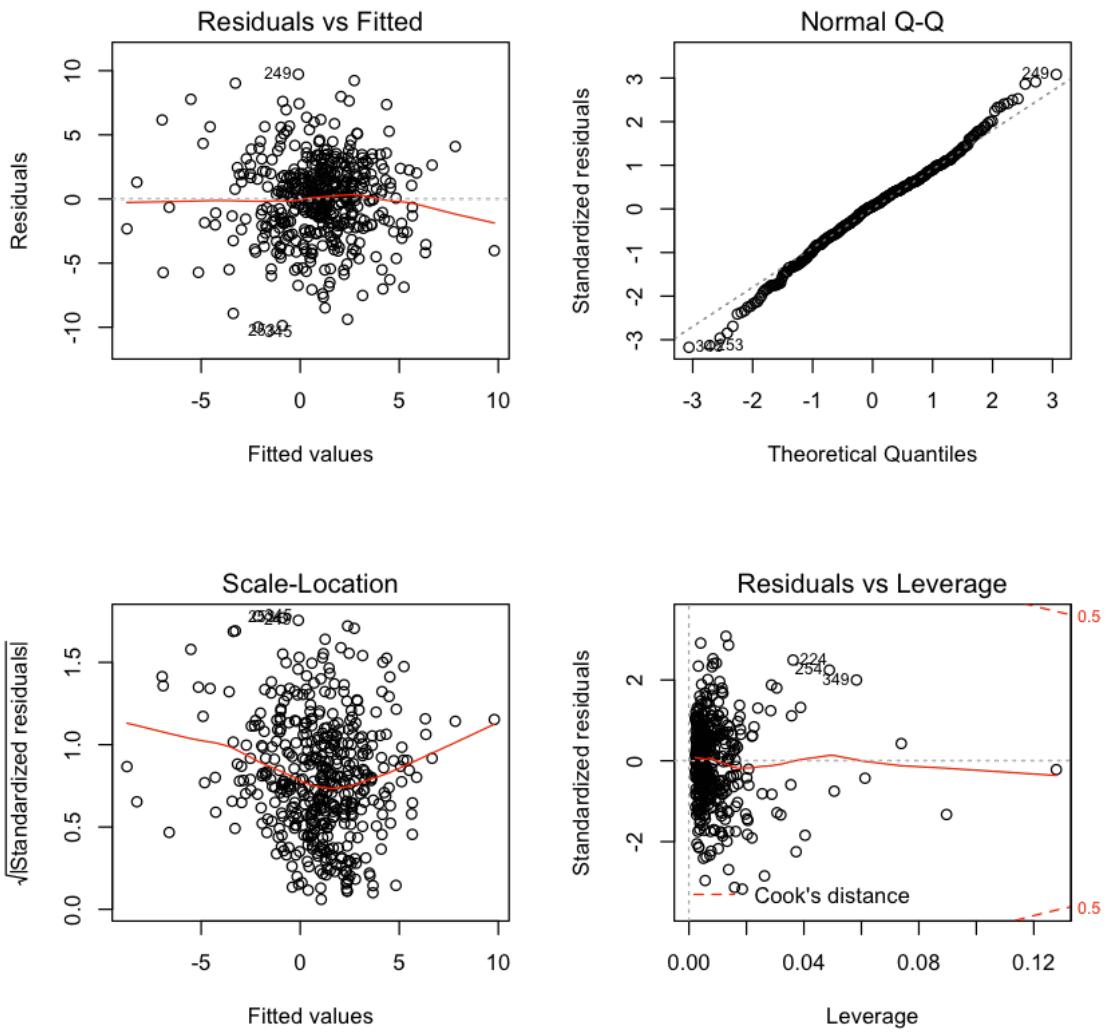
```
In [36]: lmod2=lm(`Utils` ~ `Mkt-RF`+`SMB`+`HML`, data = average_returns)
         summary(lmod2)
         par(mfrow = c(2,2)); plot(lmod2)
```

```
Call:
lm(formula = Utils ~ `Mkt-RF` + SMB + HML, data = average_returns)

Residuals:
    Min      1Q  Median      3Q     Max
-9.9846 -1.8966  0.1861  1.9412  9.7221

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.57681    0.15203   3.794 0.000168 ***
`Mkt-RF`     0.52598    0.03566  14.752  < 2e-16 ***
SMB         -0.25546    0.05199  -4.914 1.25e-06 ***
HML          0.29528    0.05389   5.480 7.09e-08 ***
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1

Residual standard error: 3.175 on 452 degrees of freedom
Multiple R-squared:  0.3396,Adjusted R-squared:  0.3352
F-statistic: 77.49 on 3 and 452 DF,  p-value: < 2.2e-16
```


Residuals vs Fitted
Residuals
Fitted values
249
Normal Q-Q
Standardized residuals
Theoretical Quantiles
249
Scale-Location
√|Standardized residuals|
Fitted values
Residuals vs Leverage
Standardized residuals
Leverage
Cook's distance
224
254
349
0.5
0.5