1. A hat to F hat

Results

1. CAPM

* \hat{a}: -0.00171037, \hat{b}: 0.96466196

1. 5-Factor Model

* \hat{a}: -0.00226, \hat{b}: 1.00901, \hat{c}: -0.16459, \hat{d}: 0.02549, \hat{e}: 0.05976, \hat{f}: 0.04363

Even after we added four more explanatory variables in the regression model, beta, a measure of systematic risk affects the dependent variable the most per unit of change of the explanatory variable. \hat{b} is greater than all the other coefficients combined. The big correspondence between the returns of the market and the S\&P 500 shows why the S\&P 500 has been used as a representative market index so far.

Risk factor for size effect (“SMB”, or \hat{c} in this example) has a negative coefficient. One possible explanation for this result is that since S\&P 500 consists of only big companies, it is negatively influenced by the change of the size effect (small minus big).

1. T-test for a to f under the default null hypotheses.

Result

* \hat{a}:-12.89008 , \hat{b}: 230.12472, \hat{c}: -26.26805, hat{d}: 3.17205, hat{e}: 7.21388, \hat{f}: 3.72025
* Degree of Freedom = 404 – 6 = 398
* Null Hypotheses (H0) are that a = 0, b=0, c=0, d=0, d=0, e=0, and f=0
* Alternative hypotheses (H1) are that a≠0, b≠0, c≠0, d≠0, e≠0, and f≠0
* Critical value at 5% significance level = \pm 1.96594

The test statistics for every coefficient falls outside of critical values, and thus we reject the null hypotheses for all the coefficient that each has zero value.

In conclusion, there is a linear relationship between each of five factors – Mkt-Rf, SMB, HML, RMW, and CMA – and the return of the S\&P 500 index.