# Fama and French Three-Factor Model

Statistical Methods in Finance

# Fama and French Three-Factor Model

- Recall CAPM uses only the excess return of the market portfolio (over the risk-free asset) as the risk factor for the excess return of the individual asset (over the risk-free asset).
- Factor model generalizes CAPM by incorporating more factors.
- Fama and French Three-Factor Model, for instance, includes small minus big (SMB) and high minus low (HML) as additional factors.
- SMB is the difference in returns on a portfolio of small stocks and a portfolio of large stocks, in term of the market value.
- HML is the difference in returns on a portfolio of high book-to-market value stocks and a portfolio of low book-to-market value stocks.

# Fama and French Three-Factor Model

- Mathematically, Fama and French models the return of the $j$-th asset for the $t$-th holding period, $R_{j,t}$, to be
- $R_{j,t} - \mu_{f,t} = \beta_{0,j} + \beta_{1,j}(R_{M,t} - \mu_{f,t}) + \beta_{2,j}SMB_t + \beta_{3,j}HML_t + \varepsilon_{j,t}$
- $\mu_{f,t}$ and $R_{M,t}$ denote the risk-free rate and the market return for the $t$-th period respectively.
- The coefficients $\beta_{1,j}$, $\beta_{2,j}$ and $\beta_{3,j}$ are the loadings of the $j$-th asset on the three factors respectively.
- For each asset, we could fit a linear regression of its excess return on the market excess return, SMB and HML.
- As an illustration, we follows the example in the textbook, using GE, IBM and Mobil as individual assets.

# Fama and French Three-Factor Model

```
lm(formula = cbind(ge, ibm, mobil) ~ Mkt.RF + SMB + HML)

Coefficients:
             ge        ibm       mobil
(Intercept)   0.3443   0.1460   0.1635
Mkt.RF        1.1407   0.8114   0.9867
SMB          -0.3719  -0.3125  -0.3753
HML           0.0095  -0.2983   0.3725
```

- All three stocks possess negative coefficients on SMB, which means they perform like big stocks.
- GE and Mobil have positive coefficients on HML, suggesting that they behave like value stocks (high book-to-market value).
- IBM has negative coefficients on HML, so it is more like a growth stock (low book-to-market value).