2

CAPM model & extensions

Classic CAPM

values hold only w/ a joint normal dist.

$$R_{it} - R_{ft} = \alpha + \beta(R_{mt} - R_{ft}) + \varepsilon$$

- R_{it}: given asset return
- R_{ft}: risk free asset return
- $R_{it} - R_{ft}$: excess return on asset
- R_{mt}: market return
- $R_{mt} - R_{ft}$: excess return on mkt

The risk of asset i → $\alpha = E(y) - \beta E(x)$

$$\beta = \frac{\sigma_{xy}}{\sigma_x^2}$$

- $\beta > 1$ = aggressive
- $\beta = 1$ = benchmark
- $0 < \beta < 1$ = conservative
- $-1 < \beta < 0$ = imperfect hedge
- $\beta = -1$ = perfect hedge

CAPM extensions

5 factor

3 factor

$$R_{it} - R_{ft} = \alpha - \beta_1(R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \varepsilon$$

- SMB_t: Small minus big ↳ diff. b/w avg. return b/w small & big portfolios
- HML_t: High minus low ↳ diff. b/w avg return b/w value & growth ports.
- RMW_t: Robust minus weak ↳ diff b/w avg return on robust & weak operating prof. ports.
- CMA_t: Cons. minus Agg. ↳ Avg. return on conservative ports vs. aggress. ports.

note: when comparing classical vs. updated, it's likely 3/5 factors will be sig. due to omitted variable issues.

↳ However, if β does not change, the F-test is not binding.