

We can generalize this model to N factors:

$$E[R_S] = r_f + \sum_{i=1}^n \beta_S^{F_i} (E[R_{F_i}] - r_f)$$

Factor selection in a Multifactor Model

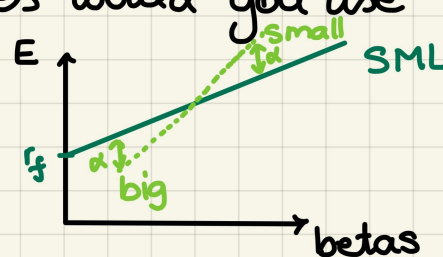
(aka Arbitrage Pricing Theory)

- Include: The Market Portfolio (financed by risk-free borrowing).

Q: What other portfolios would you include?

More precisely, which investment strategies would you use to construct the other portfolios?

$\left\{ \begin{array}{l} \text{Book-to-Market Ratio} \\ \text{Market Capitalization} \\ \text{Momentum Strategy} \end{array} \right\}$



Market Capitalization.

- Order the stocks by their MV.
- Find the median.
- Create S as the equally weighted portfolio w/ stocks below the median.
- Create B as the equally weighted portfolio w/ stocks above the median.
- Long S and short B to obtain **Small minus Big (SMB)**.

Book-to-Market Ratio.

- Order the stocks by their $\frac{BV}{MV}$.
- Construct L as the equally weighted portfolio w/ the lowest 30% of stocks.
- Construct H as the equally weighted portfolio w/ the highest 30% of stocks.
- Long H and short L to obtain the **High minus Low (HML)**.

Momentum Strategy.

- Order the stocks according to their returns over the last year.
- Create a portfolio so that you: Long the top 30% and Short the bottom 30%
- The portfolio you obtain: PR1YR

Fama-French-Carhart Factor Specification.

$$\begin{aligned} E[R_S] - r_f = & \beta_S^{\text{Mkt}} (E[R_{\text{Mkt}}] - r_f) \\ & + \beta_S^{\text{SMB}} E[R_{\text{SMB}}] \\ & + \beta_S^{\text{HML}} E[R_{\text{HML}}] \\ & + \beta_S^{\text{PR1YR}} E[R_{\text{PR1YR}}] \end{aligned}$$