

### Capital Asset Pricing Model

$$E[R_i] = R_f + B(E[R_M] - R_f)$$

where:  $R_i$  - return at time  $t$

$R_M$  - market return

$R_f$  - risk-free rate

$B$  - sensitivity

$(R_M - R_f)$  - market risk premium

### Arbitrage Pricing Theory

Black-Scholes

Black-Scholes-Merton

Arrow-Debreu

Martingales

Modern Portfolio Theory

### Fama and French Three Factor Model

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1(R_{Mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_{it}$$

where:  $R_{it}$  - Return of asset/portfolio  $i$  at time  $t$

$R_{ft}$  - Risk free rate at time  $t$

$R_{Mt}$  - Market return at time  $t$

$R_{it} - R_{ft}$  - Expected Excess Return

$R_{Mt} - R_{ft}$  - Market Excess Return ( $\sim$  market risk premium)

$SMB_t$  - Size premium (small minus big)

$HML_t$  - Value premium (high minus low)

$\beta_{1,2,3}$  - Factor coefficients

### Carhart Four Factor Model

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1(R_{Mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 MOM_t + \epsilon_{it}$$

where:  $MOM$  - Momentum

### Fama and French Five Factor Model